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ABSTRACT

This document is intended to help education and training institutions deliver the Machine Tool Advanced Skills Technology (MAST) curriculum to a variety of individuals and organizations. MAST consists of industry-specific skill standards and model curricula for 15 occupational specialty areas within the U.S. machine tool and metals-related industries. This volume provides the MAST standards and curriculum for the industrial maintenance technology specialty area. (An industrial maintenance mechanic uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair, and install equipment and machinery used in industry.) This volume is organized in the following sections: (1) a profile of Augusta Technical Institute (Georgia), the development center that produced these standards and curriculum; (2) an industrial maintenance mechanic competency profile of job duties and tasks; (3) an industrial maintenance mechanic duty, task, and subtask outline; (4) a course curriculum outline and course descriptions; (5) a technical workplace competencies and course crosswalk; and (6) a Secretary's Commission on Achieving Necessary Skills (SCANS) proficiencies course crosswalk. Individual syllabi for the following courses are provided: Algebraic Concepts; Direct Current Circuits I; Industrial Maintenance Safety Procedures; Industrial Mechanics I; Introduction to Microcomputers; English; Alternating Current I-II, Pumps and Piping Systems; Industrial Hydraulics; Interpersonal Relations and Professional Development; Industrial Mechanics II; Industrial Pneumatics; Refrigeration Fundamentals; Metal Welding and Cutting Techniques; Lathe Operations I; and Industrial Maintenance-Mechanical Review. Each course syllabus includes the following: course hours, course descriptions, prerequisites, required course materials, teaching and evaluation methods, lecture and laboratory outlines, course objectives for technical and SCANS competencies, and suggested references. Two appendixes contain industry competency profiles and the pilot program narrative. (KC)

ED 401 437

# Machine Tool
# Advanced
# Skills
# Technology

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## COMMON GROUND: TOWARD A STANDARDS-BASED TRAINING SYSTEM FOR THE U.S. MACHINE TOOL AND METAL RELATED INDUSTRIES

### VOLUME 7

### INDUSTRIAL MAINTENANCE TECHNOLOGY

of
a 15 volume set of Skills Standards
and
Curriculum Training Materials for the
PRECISION MANUFACTURING INDUSTRY

*Supported by*
*the Office of Vocational & Adult Education*
*U.S. Department of Education*

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AUGUSTA
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1948

Moraine Valley
Community College

SPRINGFIELD TECHNICAL
COMMUNITY COLLEGE

Texas State
Technical College
Waco

# Machine Tool Advanced Skills Technology Program

# MAST

## VOLUME 7

## INDUSTRIAL MAINTENANCE TECHNOLOGY

Supported by
The Office of Vocational and Adult Education
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# ACKNOWLEDGMENTS

This project was made possible by the cooperation and direct support of the following organizations:

- U.S. Department of Education, Office of Vocational & Adult Education
- MAST Consortia of Employers and Educators

### MAST DEVELOPMENT CENTERS

Augusta Technical Institute - Itawamba Community College - Moraine Valley Community College - San Diego City College (CACT) - Springfield Technical Community College - Texas State Technical College

### INDUSTRIES

AB Lasers - AIRCAP/MTD - ALCOA - American Saw - AMOCO Performance Products - Automatic Switch Company - Bell Helicopter - Bowen Tool - Brunner - Chrysler Corp. - Chrysler Technologies - Conveyor Plus - Darr Caterpillar - Davis Technologies - Delta International - Devon - D. J. Plastics - Eaton Leonard - EBTEC - Electro-Motive - Emergency One - Eureka - Foster Mold - GeoDiamond/Smith International - Greenfield Industries - Hunter Douglas - Industrial Laser - ITT Engineered Valve - Kaiser Aluminum - Krueger International. - Laser Fare - Laser Services - Lockheed Martin - McDonnell Douglas - Mercury Tool - NASSCO - NutraSweet - Rapistan DEMAG - Reed Tool - ROHR, International - Searle - Solar Turbine - Southwest Fabricators - Smith & Wesson - Standard Refrigeration - Super Sagless - Taylor Guitars - Tecumseh - Teledyne Ryan - Thermal Ceramics - Thomas Lighting - FMC, United Defense - United Technologies Hamilton Standard

### COLLEGE AFFILIATES

Aiken Technical College - Bevil Center for Advanced Manufacturing Technology - Central Florida Community College - Chicago Manufacturing Technology Extension Center - Great Lakes Manufacturing Technology Center - Indiana Vocational Technical College - Milwaukee Area Technical College - Okaloosa-Walton Community College - Piedmont Technical College - Pueblo Community College - Salt Lake Community College - Spokane Community College - Texas State Technical Colleges at Harlington, Marshall, Sweetwater

### FEDERAL LABS

Jet Propulsion Lab - Lawrence Livermore National Laboratory - L.B.J. Space Center (NASA) - Los Alamos Laboratory - Oak Ridge National Laboratory - Sandia National Laboratory - Several National Institute of Standards and Technology Centers (NIST) - Tank Automotive Research and Development Center (TARDEC) - Wright Laboratories

### SECONDARY SCHOOLS

Aiken Career Center - Chicopee Comprehensive High School - Community High School (Moraine, IL) - Connally ISD - Consolidated High School - Evans High - Greenwood Vocational School - Hoover Sr. High - Killeen ISD - LaVega ISD - Lincoln Sr. High - Marlin ISD - Midway ISD - Moraine Area Career Center - Morse Sr. High - Point Lamar Sr. High - Pontotoc Ridge Area Vocational Center - Putnam Vocational High School - San Diego Sr. High - Tupelo-Lee Vocational Center - Waco ISD - Westfield Vocational High School

## ASSOCIATIONS

American Vocational Association (AVA) - Center for Occupational Research and Development (CORD) - CIM in Higher Education (CIMHE) - Heart of Texas Tech-Prep - Midwest (Michigan) Manufacturing Technology Center (MMTC) - National Coalition For Advanced Manufacturing (NACFAM) - National Coalition of Advanced Technology Centers (NCATC) - National Skills Standards Pilot Programs - National Tooling and Machining Association (NTMA) - New York Manufacturing Extension Partnership (NYMEP) - Precision Metalforming Association (PMA) - Society of Manufacturing Engineers (SME) - Southeast Manufacturing Technology Center (SMTC)

## MAST PROJECT EVALUATORS

Dr. James Hales, East Tennessee State University and William Ruxton, National Tooling and Machine Association (NTMA)

## SPECIAL RECOGNITION

Dr. Hugh Rogers recognized the need for this project, developed the baseline concepts and methodology, and pulled together industrial and academic partners from across the nation into a solid consortium. Special thanks and singular congratulations go to Dr. Rogers for his extraordinary efforts in this endeavor.

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This report is primarily based upon information provided by the above companies, schools and labs. We sincerely thank key personnel within these organizations for their commitment and dedication to this project. Including the national survey, more than 3,000 other companies and organizations participated in this project. We commend their efforts in our combined attempt to reach some common ground in precision manufacturing skills standards and curriculum development.

This material may be found on the Internet at **http://machinetool.tstc.edu**

# CATALOG OF 15 VOLUMES

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# VOLUME 7
# INDUSTRIAL MAINTENANCE TECHNOLOGY

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# FOREWORD

Advanced technology has changed forever the nature of employment in modern manufacturing. As traditional assembly operations are supplanted by automation or made redundant through streamlining of the manufacturing process, the inevitable result is a reduction in the number of workers employed in manufacturing and an increasing reliance on machines of ever greater complexity. In the past, if a worker became ill on a manufacturing line, he could be replaced by another worker at a cost of only a few more dollars per hour; in today's manufacturing environment, if a machine or process goes down or malfunctions it likely represents a potentially enormous loss in capital investment, time, and productivity. As the machine dominates more and more of the manufacturing enterprise, expert maintenance of industrial machinery becomes an increasingly crucial aspect of manufacturing success.

The task of installing and maintaining the machines that contribute to the final output of the manufacturing process falls on the **Industrial Maintenance Mechanic**. More than any other technician in the metals industry, the modern Industrial Maintenance Mechanic must be a jack of all trades. Akin to the millwright of the past era, the Industrial Maintenance Mechanic must understand the general operation of all machines, mechanical or electrical, conventional or computer controlled, that contribute to the manufacturing process. At the same time, as new employment opportunities in industrial maintenance begin to appear, efforts to find qualified applicants to fill the positions are often complicated by difficulty in defining the occupation and identifying standard entry-level skills.

**Recognizing the need to increase the supply of new skilled workers in this and other occupations for the metal and metals-related industries, the U.S. Department of Education launched the Cooperative Demonstration Program (Manufacturing Technologies) as part of the National Skills Standards Act of 1994. The goal of the Department initiative was to foster the development and implementation of national skill standards and a training model for certificate and Associate of Science degree programs. In July 1994, a multi-state consortium of community colleges led by Texas State Technical College received a grant awarded by the Department under the initiative. The Machine Tool Advanced Skills Technology (MAST) consortium, which includes six of the nation's leading Advanced Technology Centers (ATCs), was formed to develop, test and disseminate industry-specific skill standards and model curricula for the U.S. machine tool industry over a two year period. As part of the MAST consortium, Augusta Technical Institute in Georgia was tasked with developing and piloting skill standards and model curricula in the technical area of Industrial Maintenance Mechanic.**

While it is clear that the modern Industrial Maintenance Mechanic must know something about all aspects of modern industrial equipment, there has not been widespread agreement regarding the depth and extent of that knowledge. The present report provides the results of the Augusta project in creating the foundation for such agreement, through developing skill standards and a curriculum to guide the education of the modern Industrial Maintenance Mechanic. The skill standards and curriculum are the result of numerous interviews with practitioners from industry (see Appendix A) and discussions with educators, managers, supervisors, and others involved with machine maintenance. Based on discussion with the other MAST consortium partners, the project presents the following definition of the new occupation:

**INDUSTRIAL MAINTENANCE MECHANIC**: *The industrial maintenance mechanic uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.*

The Industrial Maintenance Mechanic program designed and offered by Augusta Technical Institute is structured as a 19-course, two-year course of study. The present volume provides the occupational skill standards, project documentation, and course syllabi for education and training recommended as minimum preparation for an individual desiring to become an industrial maintenance mechanic. Reflecting the diversity of skills needed to maintain modern manufacturing systems, the curriculum includes courses ranging from industrial mechanics and refrigeration fundamentals to an introduction to microcomputer operations and electrical systems.

# PARTNER OCCUPATIONAL SPECIALITY ASSIGNMENTS

Although each of the six partner college development centers possessed detailed expertise in each of the MAST 15 occupational specialities, a division of work was still very necessary to ensure completion of the project due to the enormity associated with industrial assessment and complete curriculum revision for each of the areas of investigation.

Each Collegiate Partner was responsible for development of a specialization component of the overall model. Information for the future direction of this specialization area was obtained from NIST Manufacturing Centers and/or national consortia, professional societies, and industrial support groups addressing national manufacturing needs. Each Collegiate Partner tested its specialization model utilizing local campus resources and local industry. Information gained from the local experience was utilized to make model corrections. After testing and modification, components were consolidated into a national model. These events occurred during the first year of the Program. During the second year of the Program, the national model was piloted at each of the Collegiate Partner institutions. Experience gained from the individual pilot programs was consolidated into the final national model.

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What follows is a profile of the MAST development center which had primary responsibility for the compilation and preparation of the materials for this occupational specialty area. This college also had the responsibility for conducting the pilot program which was used as one of the means of validation for this program.

## MAST DEVELOPMENT CENTER, AUGUSTA, GA
### Advanced Manufacturing Technology Center
### Augusta Technical Institute

Kenneth Breeden, Commissioner
Georgia Department of Technical and Adult Education
Jack Patrick, President
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### Manufacturing in the Augusta Region

Augusta is the second largest city in Georgia and manufacturing represents the largest sector of the Augusta economy. The region is home to 810 manufacturers employing 89,717 people, an industrial base consisting of about 75% process control and 25% discrete parts production facilities. Major areas of emphasis for industry include technology transfer, factory floor training, and job certification programs. Growth of manufacturing in the region has been driven by Augusta's high tech development in electronics, process control, telecommunications, computers, medical services and instrumentation.

### Augusta Technical Institute and Advanced Manufacturing Technology Center (AMTEC)

Augusta Technical Institute (ATI) is part of Georgia's Department of Technical and Adult Education system, serving a large percentage of the two-state Central Savannah River area through its main campus and satellite facilities. The student body includes vocational-technical and college prep students, as well as current workers seeking retraining or skills upgrade; ATI has long emphasized outreach and special attention to the needs of low income, rural and disadvantaged residents, as well as displaced workers, single parents, women in non-traditional fields, and the disabled. In 1983, the Institute used the opportunity to host one of Georgia's new regional advanced technology centers (ATC's) to streamline its technical programs and thereby help to ensure the future employability of its students. ATI's Advanced Manufacturing Technology Center (AMTEC) is designed to provide technology research and demonstration, industry assessments, technical consulting, and industry-specific contract training for the many established and emerging high tech companies in the Augusta region.

### Development Team

- **Project Director:** Jim Weaver, PhD., Director of AMTEC, served as program director for the MAST project.
- **Subject Matter Expert**: Ronnie Lambert, MS, MAST Site Coordinator, had program responsibility for developing skill standards based on the industry skills verification process, as well as developing course curricula and program materials for the MAST pilot program in Industrial Maintenance Mechanic and Instrumentation Technician. Mr. Lambert has taught Industrial Maintenance Mechanic and Instrumentation for 32 years in colleges and industry across the Southeast.
- **Subject Matter Expert**: Bob Johnson, BS, Project Development, was responsible for developing skill standards for the MAST project. Mr. Johnson has 27 years of experience in process-related industry and training in both technical schools and industry; he is certified in many process-related specialty areas.

# THE MAST COMPETENCY PROFILE

Development of Competency Profiles at each of the MAST sites began with visits to representative companies for the purpose of surveying expert workers within the industry and occupational areas under investigation. Each site began the survey process by asking a subject matter expert in the targeted technical area, generally a member of their faculty, to employ a modified version of the generally-accepted DACUM (Developing A Curriculum) method to categorize the major skills needed to work in the selected occupation. As source materials, the college instructors drew on their professional knowledge and experience of current and future industry requirements. The initial skill standards developed by the subject matter experts underwent numerous internal reviews and revisions within each site, assuming final form as a series of structured survey and interview statements designed to elicit a simple yes or no response.

To determine an appropriate survey sample, each site compiled a database of their region's small and medium-sized manufacturers and searched for companies likely to employ workers in the targeted occupational area. The resulting cross-industry samples were sorted further to achieve a balance of technological capability and workforce size; the sample companies within each region were then asked to participate in the project. Willing respondents were scheduled for interviews.

During the company interviews, MAST staff asked expert workers to identify the primary duties and tasks performed by a typical worker and to consider the special skills and knowledge, traits and attitudes, and industry trends that will have an impact on worker training, employability, and performance both now and in the future. The interview results were analyzed to create individual profiles identifying the most common duties and skills required of workers at each company. Copies of individual company competency profiles are provided in Appendix A of this volume. These individual company Competency Profiles served two purposes. First, they showed, in a format that could be easily understood by both industry and educators, a picture of the occupational specialty at a given company at that particular time. Second, these individual company Competency Profiles furnished the company with a document for which they could claim ownership. This, in effect, made them "real" partners in the work of MAST.

Data for all companies were then aggregated to develop a composite Competency Profile of industry skill standards within the selected occupational specialty area of, as shown in the following pages.

These same duties and tasks were then included in both the Texas and National Surveys for further validation (see Volume 1). As a result of the surveys, additional refinements were made to the Competency Profiles. These changes were then incorporated into the individual course syllabi which were used for the pilot program.

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The MAST Competency Profile for this occupational specialty area has been included on the following pages.

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

## AUGUSTA TECHNICAL INSTITUTE MAST PROGRAM REPRESENTATIVES

DR. JIM WEAVER
Site Administrator

RONNIE LAMBERT
Site Coordinator

STEPHEN GRIGGS
Advisor

PAM PHILLIPS
Secretary

ROBERT TANKERSLEY
Instructor - Industrial Maintenance Technology

THOMAS SANCHEZ
Instructor - Industrial Maintenance Technology

AMTEC

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic Presses
Welding Equipment (SMAW, GMAW)
Alignment/Calibration Tools
Computer
Personal Safety Equipment
Oxyacetylene Equipment
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Power Transmission Devices
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Rigging Equipment

## FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

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## COMPETENCY PROFILE

# Industrial Maintenance Mechanic

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortium Partners**
**(V.199J40008)**

## *M*achine Tool *A*dvanced *S*kills *T*echnology Program

MAST

**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Safety | A-1 Follow safety manuals and all safety regulations/ requirements | A-2 Use protective equipment | A-3 Follow safe operating procedures for hand and machine tools | A-4 Maintain a clean and safe work environment | | | | | | | | | |
| B | Apply Mathematical Concepts | B-1 Perform basic arithmetic functions | B-2 Convert fractions/ decimals | B-3 Convert Metric/English measurements | B-4 Perform basic algebraic operations | B-5 Perform basic trigonometric functions | B-6 Calculate speeds and feeds for machining | | | | | | | |
| C | Interpret Engineering Drawings and Control Documents | C-1 Review blueprint notes and dimensions | C-2 Identify basic layout of drawings | C-3 Identify basic types of drawings | C-4 List the purpose of each type of drawing | C-5 Verify drawing elements | C-6 Practice Geometric Dimensioning and Tolerancing GD&T) methodology | C-7 Describe the relationship of engineering drawings to planning | C-8 Use standards to verify requirements | C-9 Analyze Bill of Materials (BOM) | C-10 Read/ interpret prints from different occupations | | | |
| D | Use Precision Measuring Tools | D-1 Identify types of measurement | D-2 Select proper measurement tools | D-3 Apply proper measuring techniques | D-4 Use Metric and English standards of measurement | D-5 Perform measurements with hand held instruments | D-6 Perform measurements on surface plate | D-7 Perform inspections using stationary equipment | | | | | | |
| E | Use Hand Tools | E-1 Use proper hand tools | E-2 Install helicoils | E-3 Use drill motors | E-4 Use impact wrenches | E-5 Use torque wrenches | E-6 Use gasket cutters | E-7 Install safety wire | | | | | | |
| F | Operate Machine Tools | F-1 Prepare and plan for machining operations | F-2 Operate power saws | F-3 Operate drill presses | F-4 Operate vertical milling machines | F-5 Operate horizontal milling machines | F-6 Operate metal cutting lathes | F-7 Operate grinding/ abrasive machines | F-8 Operate deburring equipment | F-9 Operate metal shears | F-10 Operate brakes | F-11 Operate hydraulic/ mechanical presses | | |
| G | Perform Welding Operations | G-1 Weld with Shielded Metal Arc Welding (SMAW) process | G-2 Weld/cut with oxyacetylene | G-3 Weld with Gas Tungsten Arc Welding (GTAW) (Heliarc) | G-4 Weld with Gas Metal Arc Welding (GMAW) / (MIG) and Flux Core Arc Welding (FCAW) | | | | | | | | | |
| H | Troubleshoot Equipment and Systems | H-1 Maintain air conditioning systems | H-2 Maintain electrical control circuits | H-3 Program PLCs | H-4 Maintain pneumatic control systems | H-5 Trouble-shoot motors | H-6 Trouble-shoot centrifugal pumps | H-7 Trouble-shoot positive displacement pumps | H-8 Maintain compressors | H-9 Trouble-shoot blowers | H-10 Understand turbines (gas, steam) | H-11 Install piping | | |
| I | Repair Industrial Power Plant Systems | I-1 Trouble-shoot small gasoline engines | I-2 Trouble-shoot medium size gasoline engines | I-3 Trouble-shoot medium size natural gas powered engines | I-3 Trouble-shoot medium size natural gas powered engines | I-4 Trouble-shoot medium size diesel engines | I-5 Trouble-shoot diesel and industrial power plants | I-6 Trouble-shoot steam turbines | I-7 Trouble-shoot gas turbines | | | | | |
| J | Repair Power Transmission Systems | J-1 Trouble-shoot gear power transmission drives | J-2 Trouble-shoot chain power transmission drives | J-3 Trouble-shoot belt drive systems | J-4 Trouble-shoot bearings (plane, journal and antifriction) | | | | | | | | | |

[illegible]

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** | **Fabricate/ Install Sheet Metal Parts** | K-1 Layout sheet metal parts | K-2 Form and/ or bend sheet metal parts | K-3 Fasten sheet metal parts together | | | | | | | | | | |
| **L** | **Select Equipment for Manufacturing Applications** | L-1 Evaluate/ recommend condensing units | L-2 Evaluate/ recommend furnaces | L-3 Evaluate/ recommend chillers | L-4 Evaluate/ recommend cooling towers | L-5 Evaluate/ recommend pumps | L-6 Evaluate/ recommend compressors | L-7 Evaluate/ recommend hydraulic units | L-8 Requisition/order parts | | | | | |
| **M** | **Join Pipes** | M-1 Solder metal pipes | M-2 Braze or silver solder metal pipes | M-3 Weld metal pipe joints | M-4 Flair metal tubing | M-5 Swage metal pipe/ tubing | M-6 Join metal pipe with threads | M-7 Join metal pipe with cement | M-8 Join metal pipes with flange joint | M-9 Join plastic pipes with glue | M-10 Join plastic pipes with hot air welding process | | | |
| **N** | **Construct Air Distribution Systems** | N-1 Fabricate loop systems | N-2 Fabricate dead and systems | N-3 Fabricate branch systems | N-4 Fabricate pipe and duct supports | | | | | | | | | |
| **O** | **Start-Up New Air Conditioning Systems** | O-1 Check for leaks | O-2 Check for safe operation | O-3 Evacuate and charge system | O-4 Perform safe reclamation | O-5 Troubleshoot systems | O-6 Fill hydraulic systems and set flow through coils | O-7 Install thermostats and low voltage wiring | O-8 Install diffusers | | | | | |
| **P** | **Maintain Boiler and Steam Systems** | P-1 Troubleshoot systems | P-2 Adjust systems for optimum performance | | | | | | | | | | | |
| **Q** | **Maintain Hydraulic/ Pneumatic Devices** | Q-1 Demonstrate working knowledge of hydraulic systems | Q-2 Repair/ replace pumps | Q-3 Repair/ replace valves | Q-4 Repair/ replace cylinders | Q-5 Repair/ replace filters | Q-6 Replace seals | Q-7 Clean/fill reservoirs | Q-8 Replace hoses and couplers | Q-9 Repair/ replace motors | Q-10 Perform PM and service as needed | | | |
| **R** | **Perform Non-Destructive Testing** | R-1 Make industrial x-ray inspection | R-2 Test using ultrasonic process | R-3 Test using vibration analysis | | | | | | | | | | |
| **S** | **Use Computers** | S-1 Use Lotus 1-2-3 or Quattro Pro | S-2 Use WodPerfect | S-3 Work in a Windows environment | S-4 Use AutoCAD | S-5 Use maintenance programs | S-6 Program ladder logic for PLCs | | | | | | | |
| **T** | **Align Shafts** | T-1 Use feeler gauges | T-2 Use single indicator | T-3 Use double indicator | T-4 Use double reverse indicator | T-5 Use Laser | | | | | | | | |

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **U** | **Install/Align Machines** | U-1 Install electrical connections | U-2 Perform required pipe fitting tasks | U-3 Grout as necessary | U-4 Discuss mounting methods | U-5 Level and align machine components | U-6 Discuss finishing materials (i.e., paints, sealers) | U-7 Use stud gun | U-8 Perform electrical and pneumatic drilling operations | | | | | |
| **V** | **Demonstrate Knowledge of Building Construction** | V-1 Discuss wood framing techniques | V-2 Discuss metal framing techniques | V-3 Discuss sheeting processes | V-4 Discuss concrete forms and formula testing | V-5 Discuss grouting materials | V-6 Discuss surveying applications and methods | | | | | | | |
| **W** | **Maintain Electrical Devices** | W-1 Use electrical test equipment | W-2 Apply specific terms to electrical circuits | W-3 Analyze series, parallel and complex DC/AC circuits | W-4 Check AC and DC motors | W-5 Inspect transformers and generators | W-6 Discuss sensors and feedback technology | W-7 Set up/ program PLC | W-8 Troubleshoot electrical devices | | | | | |

# THE MAST TECHNICAL WORKPLACE COMPETENCY OUTLINE

The Competency Profiles derived from the industry survey process were returned to industry and faculty members at each MAST partner college for review. Reviewers were asked to identify specific sub-tasks within each block of Duties and Tasks in the Profile; MAST staff at each college broke the sub-tasks down further into the detailed steps required to actually perform the duties and tasks of the manufacturing process. It is these detailed skill standards that were then incorporated into development of the curriculum and piloted as a training program by each of the MAST colleges. All results for the specific occupational specialty area have been organized as an outline of the duties, tasks, and sub-tasks required to demonstrate technical competency in the workplace, as shown in the following pages.

As a result of the Texas and the National Surveys, additional refinements were made to the Competency Outlines. These changes were then incorporated into the individual course syllabi.

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The MAST Technical Workplace Competency Outline for this occupational specialty area has been included on the following pages.

# INDUSTRIAL MAINTENANCE MECHANIC
## TECHNICAL WORKPLACE COMPETENCIES

**INDUSTRIAL MAINTENANCE MECHANIC**...*uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.*

A. **PRACTICE SAFETY**
  1. Follow Safety Manuals and All Safety Regulations/Requirements
    a. Assume responsibility for the personal safety of oneself and others
    b. Develop a personal attitude towards safety
    c. Interpret safety manual directives
    d. Comply with established company safety practices
  2. Use Protective Equipment
    a. Wear protective safety clothing as required
    b. Maintain and use protective guards and equipment on machinery
    c. Locate and properly use protective equipment
    d. Use lifting aids when necessary
  3. Follow Safe Operating Procedures for Hand and Machine Tools
    a. Identify and understand safe machine operating procedures
    b. Demonstrate safe machine operation
  4. Maintain a Clean and Safe Work Environment
    a. Keep work areas clean
    b. Clean machine/hand tools when work is completed
    c. Put tools away when work is finished
    d. Keep aisles clear of equipment and materials
    e. Perform preventative maintenance as required

B. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Functions
    a. Add, subtract, multiply, and divide whole numbers
    b. Add, subtract, multiply, and divide fractions
    c. Add, subtract, multiply, and divide decimals
  2. Convert Fractions/Decimals
    a. Convert fractions to decimal equivalents
    b. Convert decimal values to nearest fractional equivalent
    c. Use Decimal Equivalent Chart for conversions
  3. Convert Metric/English Measurements
    a. Convert English dimensions to Metric
    b. Convert Metric dimensions to English
    c. Use Metric/English conversion chart
  4. Perform Basic Algebraic Operations
    a. Express word statements as algebraic equations
    b. Solve word statements as algebraic equations
  5. Perform Basic Trigonometric Functions
    a. Solve for unknown angles

  - b. Solve for unknown sides
  - c. Calculate bolt hole patterns
- 6. Calculate Speeds and Feeds for Machining
  - a. Calculate RPM for various metals and various tools
  - b. Calculate feed for various metals, tools, and depths of cut

## C. INTERPRET ENGINEERING DRAWINGS AND CONTROL DOCUMENTS

- 1. Review Blueprint Notes and Dimensions
  - a. Explain basic blueprint terminology
  - b. Identify the types of dimensions
  - c. Identify general note symbols
  - d. Locate notes on a print
  - e. Interpret commonly used abbreviations and terminology
  - f. Determine tolerances associated with dimensions on a drawing
  - g. Determine the tolerance for a reference dimension
  - h. Determine the surface finish for a given part
  - i. List the essential components found in the general drawing notes
- 2. Identify Basic Layout of Drawings
  - a. Identify types of lines within a drawing
  - b. Identify item number symbols
  - c. Identify general note symbols
  - d. List the essential components found in the title block
  - e. Locate bill of materials in a drawing
  - f. List the components found in the revision block
- 3. Identify Basic Types of Drawings
  - a. Identify orthographic views
  - b. Identify positions of views (top, front, side, and auxiliary)
  - c. Visualize one or more views from a given view
  - d. Identify isometric views
  - e. Identify exploded isometric drawings
  - f. Identify assembly drawings
- 4. List the Purpose of Each Type of Drawing
  - a. Identify the purpose of orthographic (3 views) drawings
  - b. Identify the purpose of isometric drawing
  - c. Identify the purpose of exploded isometric drawing
  - d. Identify the purpose of assembly drawings
- 5. Verify Drawing Elements
  - a. Determine the scale of the view or section
  - b. Check for revisions
  - c. Recognize out-of-date blueprints
- 6. Practice Geometric Dimensioning and Tolerancing (GD&T) Methodology
  - a. Identify the purpose of GD&T
  - b. Identify symbols for controlling location (or true position) of part features
  - c. Identify symbols for controlling form (or alignment) of part features
  - d. Identify symbols for showing datums and basic dimensions on drawings

        e. Identify symbols for Maximum Material Size (MMS) and Regardless of Feature Size (RFS)
7. Describe the Relationship of Engineering Drawings to Planning
    a. Discuss production schedule
    b. Discuss Material Resource Planning (MRP)
    c. Discuss inventory control records
    d. Discuss shop floor routing documents
8. Use Standards to Verify Requirements
    a. Discuss the purpose of standards
    b. Discuss source locations for standards
9. Analyze Bill of Materials (BOM)
    a. Discuss components found on BOM
    b. Determine materials needed to produce the part
    c. Determine quantities necessary to produce the part
    d. Submit completed stock request form as required
    e. Submit completed tool request form as needed
10. Read/Interpret Prints from Different Occupations
    a. Interpret mechanical prints
    b. Interpret electrical prints
    c. Interpret pneumatic schematics
    d. Interpret hydraulic schematics
    e. Interpret welding prints
    f. Interpret building prints
    g. Interpret plumbing or piping prints
    h. Interpret conveyor system prints
    i. Understand bill of materials callouts

## D. USE PRECISION MEASURING TOOLS

1. Identify Types of Measurement
    a. Distinguish between direct and calculated measurements
    b. Compute calculated measurements
    c. Justify the use of precision measurements in manufacturing
    d. Discuss the following: precision, reliability and accuracy
    e. Demonstrate general measurement techniques
    f. Demonstrate semi-precision measurement techniques
    g. Demonstrate precision measurement techniques
    h. Document results of measurement activities and calculations
2. Select Proper Measurement Tools
    a. Match appropriate measurement tools with various types of measurement requirements
    b. Demonstrate proper measurement tool usage
    c. List steps of proper measurement
    d. Explain rationale for each step
    e. Identify error possibilities in measurement tool selection
    f. Identify error possibilities within measurement procedures

    - g. Identify common conversion error possibilities
    - h. Discriminate between accepted measurement procedures and improper measurement procedures
- 3. Apply Proper Measuring Techniques
    - a. Explain calibration requirements of various precision instruments
    - b. Illustrate measurement differences when taken with calibrated and non-calibrated instruments
    - c. Justify use of particular measurement tools based on tool characteristics
    - d. Discuss factors affecting accurate measurement (i.e., dirt, temperature, etc.)
- 4. Use Metric and English Standards of Measurement
    - a. Discuss the English system of measurement
    - b. Discuss the Metric system of measurement
- 5. Perform Measurements With Hand Held Instruments
    - a. Measure with steel rules (metric and inch)
    - b. Measure with micrometers
    - c. Measure with comparison measuring instruments (e.g., calipers, telescope gages)
    - d. Measure with direct measuring instruments (e.g., vernier, dial, and digital instruments)
    - e. Measure with fixed gages (go and not go gages)
- 6. Perform Measurements on Surface Plate
    - a. Describe care of surface plate
    - b. Use surface plate accessories correctly (sine bar, gage blocks, etc.)
    - c. Check for part squareness
    - d. Check part dimensions for accuracy
    - e. Align workpieces using height gage and dial indicators
- 7. Perform Inspections Using Stationary Equipment
    - a. Set up and use an Optical Comparator
    - b. Set up and use a Coordinate Measuring Machine (CMM)

## E. USE HAND TOOLS

- 1. Use Proper Hand Tools
    - a. Use arbor and shop presses
    - b. Select necessary work-holding devices and hand tools as needed
    - c. Select and use hand files
    - d. Identify and use hand reamers
    - e. Correctly identify and use hand taps as required
    - f. Follow tapping procedures to produce internal threads
    - g. Use thread-cutting dies to produce external threads
    - h. Operate bench and pedestal grinders safely
- 2. Install helicoils
- 3. Use drill motors
- 4. Use impact wrenches
- 5. Use torque wrenches

6. Use gasket cutters
7. Install safety wire

## F. OPERATE MACHINE TOOLS

1. Prepare and Plan For Machining Operations
    a. Read and interpret blueprints
    b. Perform basic semi-precision and precision layout as necessary
    c. Plan machining operations
    d. Understand machinability and chip formation
    e. Calculate speeds, feeds, and depth of cut for various machine applications
    f. Determine proper cutting fluids/coolants for machining
    g. Use carbides and other tool materials to increase productivity
    h. Use the Machinery's Handbook as a reference for machine applications
2. Operate Power Saws
    a. Use reciprocating and horizontal band cutoff machines
    b. Operate abrasive and cold saws
    c. Prepare and use the vertical band saw
    d. Weld a bandsaw blade
3. Operate Drill Presses
    a. Describe the different types of drill presses found in the machine shop
    b. Describe and use standard drilling tools
    c. Sharpen a drill bit using a bench or pedestal grinder
    d. Setup the drill presses for drilling, countersinking, counterboring, reaming, and tapping operations
    e. Drill holes using drill jigs
4. Operate Vertical Milling Machines
    a. Demonstrate the use of all controls on the vertical milling machine
    b. Align the vertical milling machine head
    c. Select, align and use work holding devices
    d. Select milling tool holders
    e. Select milling cutters
    f. Perform all standard vertical milling operations
    g. Bore a hole using the offset boring head
    h. Machine angles using sine bar and gage blocks
    i. Setup and use special vertical mill fixtures
    j. Setup and machine dovetails
    k. Machine keyways
5. Operate Horizontal Milling Machines
    a. Discuss the difference in plain and universal horizontal milling machines
    b. Discuss the types of spindles, arbors and adapters used on the horizontal milling machine
    c. List several common work holding methods
    d. Use plain milling cutters
    e. Use side milling cutters
    f. Use face milling cutters

        - g. Setup and use special horizontal mill fixtures
    - 6. Operate Metal Cutting Lathes
        - a. Demonstrate the use of all controls on the engine lathe
        - b. Discuss standard tools and toolholders for the lathe
        - c. Face and center drill parts correctly
        - d. Drill, ream and bore on the lathe
        - e. Turn between centers
        - f. Discuss alignment of lathe centers
        - g. Make all calculations, lathe adjustments and settings to machine sixty-degree internal and external threads
        - h. Discuss thread fit classifications
        - i. Make all calculations, lathe adjustments and settings to machine an Acme thread
        - j. Describe the common tapers used in the machine shop
        - k. Discuss taper cutting and calculations for the lathe
        - l. Setup and use the taper attachment found on most lathes
        - m. Use follower rests and steady rests
        - n. Use HSS cutting tools
        - o. Use carbide cutting tools
        - p. Setup and operate tracer lathes
        - q. Setup and operate turret lathes
    - 7. Operate Grinding/Abrasive Machines
        - a. Discuss the selection and identification of grinding wheels
        - b. Inspect, mount, true, dress, and balance grinding wheels
        - c. Discuss the selection of grinding fluids
        - d. Operate horizontal spindle reciprocating table surface grinders
        - e. Operate cylindrical grinders
        - f. Operate ID and OD grinders
        - g. Setup and operate tool and cutter grinders
        - h. Discuss common problems and solutions in surface grinding
        - i. Operate honing machine
        - j. Operate lapping machines
    - 8. Operate Deburring Equipment
        - a. Debur parts using pneumatic Deburring tools
        - b. Debur parts using electric deburring tools
    - 9. Operate metal shears
    - 10. Operate brakes
    - 11. Operate hydraulic/mechanical presses

## G. PERFORM WELDING OPERATIONS

- 1. Weld With Shielded Metal Arc Welding (SMAW) Process
    - a. Identify factors for welding electrode selection
    - b. Adjust welding amperage setting for each application
    - c. Demonstrate proper use of safety equipment
    - d. Weld beads on plate (flat, horizontal, and vertical)

    - e. Weld tee joints (flat, horizontal, and vertical)
    - f. Weld pipe joints
    - g. Identify weld inspection factors and techniques
2. Weld/Cut With Oxyacetylene
    - a. Setup and break down the oxyacetylene welding/cutting station
    - b. Properly adjust oxyacetylene regulators
    - c. Identify factors that determine torch welding and cutting tip selection
    - d. Demonstrate routine torch maintenance procedures
    - e. Weld beads on plate (with and without filler) in the flat and horizontal positions
    - f. Weld square groove butt joints in the flat and horizontal positions
    - g. Braze weld beads on plate in the flat position
    - h. Make square cuts to a straight line with the cutting torch
    - i. Demonstrate proper use of safety equipment
3. Weld With Gas Tungsten Arc Welding (GTAW) (Heliarc)
    - a. Set up GTAW welder for welding steel
    - b. Set up GTAW welder for welding aluminum
    - c. Weld beads on plate (steel) with appropriate filler rod in the flat position
    - d. Weld beads on plate (aluminum) with appropriate filler rod in the flat position
    - e. Weld lap joints in the horizontal position on steel plate
    - f. Weld lap joints in the horizontal position on aluminum plate
4. Weld With Gas Metal Arc Welding (GMAW)/(MIG) and Flux Core Arc Welding (FCAW)
    - a. Set up machine for gas metal arc welding
    - b. Set up machine for flux cored arc welding
    - c. Weld beads on plate with gas metal arc welding system in the flat position
    - d. Weld beads on plate with flux cored welding system in the flat position
    - e. Weld lap joints on steel plate with the gas metal arc welding system in the horizontal position
    - f. Weld lap joints on steel plate with the flux cored arc welding system in the horizontal position

## H. TROUBLESHOOT EQUIPMENT AND SYSTEMS

1. Maintain air conditioning systems
2. Maintain electrical control circuits
3. Program PLCs
4. Maintain pneumatic control systems
5. Troubleshoot motors
6. Troubleshoot centrifugal pumps
7. Troubleshoot positive displacement pumps
8. Maintain compressors
9. Troubleshoot blowers
10. Understand turbines (gas, steam)
11. Install piping

I. **REPAIR INDUSTRIAL POWER PLANT SYSTEMS**

1. Troubleshoot small gasoline engines
2. Troubleshoot medium size gasoline engines
3. Troubleshoot medium size natural gas powered engines
4. Troubleshoot medium size diesel engines
5. Troubleshoot diesel and industrial power plants
6. Troubleshoot steam turbines
7. Troubleshoot gas turbines

J. **REPAIR POWER TRANSMISSION SYSTEMS**

1. Troubleshoot gear power transmission drives
2. Troubleshoot chain power transmission drives
3. Troubleshoot belt drive systems
4. Troubleshoot bearings (plane, journal, and antifriction)

K. **FABRICATE/INSTALL SHEET METAL PARTS**

1. Layout sheet metal parts
2. Form and/or bend sheet metal parts
3. Fasten sheet metal parts together

L. **SELECT EQUIPMENT FOR MANUFACTURING APPLICATIONS**

1. Evaluate/recommend condensing units
2. Evaluate/recommend furnaces
3. Evaluate/recommend chillers
4. Evaluate/recommend cooling towers
5. Evaluate/recommend pumps
6. Evaluate/recommend compressors
7. Evaluate/recommend hydraulic units
8. Requisition/order parts

M. **JOIN PIPES**

1. Solder metal pipes
2. Braze or silver solder metal pipes
3. Weld metal pipe joints
4. Flair metal tubing
5. Swage metal pipe/tubing
6. Join metal pipe with threads
7. Join metal pipe with cement
8. Join metal pipes with flange joint
9. Join plastic pipes with glue
10. Join plastic pipes with hot air welding process

N. **CONSTRUCT AIR DISTRIBUTION SYSTEMS**

1. Fabricate loop systems
2. Fabricate dead end systems

3. Fabricate branch systems
4 Fabricate pipe and duct supports

**O. START-UP NEW AIR CONDITIONING SYSTEMS**

1. Check for leaks
2. Check for safe operation
3. Evacuate and charge system
4. Perform safe reclamation
5. Troubleshoot systems
6. Fill hydraulic systems and set flow through coils
7. Install thermostats and low voltage wiring
8. Install diffusers

**P. MAINTAIN BOILER AND STEAM SYSTEMS**

1. Troubleshoot systems
2. Adjust systems for optimum performance

**Q. MAINTAIN HYDRAULIC/PNEUMATIC DEVICES**

1. Demonstrate working knowledge of hydraulic systems
2. Repair/replace pumps
3. Repair/replace valves
4. Repair/replace cylinders
5. Clean/replace filters
6. Replace seals
7. Clean/fill reservoirs
8. Replace hoses and couplers
9. Repair/replace motors
10. Perform PM and service as needed

**R. PERFORM NON-DESTRUCTIVE TESTING**

1. Make industrial x-ray inspection
2. Test using ultrasonic process
3. Test using vibration analysis

**S. USE COMPUTERS**

1. Use Lotus 1-2-3 or Quattro Pro
2. Use WordPerfect
3. Work in a Windows environment
4. Use AUTOCAD
5. Use maintenance programs
6. Program ladder logic for PLCs

**T. ALIGN SHAFTS**

1. Use feeler gauges
2. Use single indicator

3. Use double indicator
4. Use double reverse indicator
5. Use Laser

## U. INSTALL/ALIGN MACHINES

1. Install electrical connections
2. Perform required pipe fitting tasks
3. Grout as necessary
4. Discuss mounting methods
5. Level and align machine components
6. Discuss finishing materials (i.e. paints, sealers)
7. Use stud gun
8. Perform electrical and pneumatic drilling operations

## V. DEMONSTRATE KNOWLEDGE OF BUILDING CONSTRUCTION

1. Discuss wood framing techniques
2. Discuss metal framing techniques
3. Discuss sheeting processes
4. Discuss concrete forms and formula testing
5. Discuss grouting materials
6. Discuss surveying applications and methods

## W. MAINTAIN ELECTRICAL DEVICES

1. Use Electrical Test Equipment
    a. Measure resistance with an analog volt-ohm-milliamp meter
    b. Measure voltage with volt-ohm-milliamp meter
    c. Measure current with volt-ohm milliamp meter
    d. Use wattmeter to measure power in a simple DC circuit
    e. Use oscilloscope to observe AC signals of various wave-shapes and frequencies
2. Apply Specific Terms to Electrical Circuits
    a. Define voltage, current, and resistance
    b. Discuss power, power factor, and sine-waves
    c. Define three phase, induction, and capacitance
3. Analyze Series, Parallel and Complex DC/AC Circuits
    a. Define a series circuit
    b. Define a parallel circuit
    c. Define a complex DC circuit
    d. Define an AC circuit
    e. Apply Ohm's law to each of the above circuits
    f. Apply Kirchoff's law to each of the above circuits
4. Check AC and DC Motors
    a. List types of AC and DC motors
    b. List characteristics of AC motors
    c. List characteristics of DC motors

    - d. Compare AC motors versus DC motors to job duty
5. Inspect Transformers and Generators
    - a. Define transformer construction and the principle of operation
    - b. List the different types of transformers
    - c. Define electro-magnetic induction
    - d. Describe the principle of operation of AC alternators and DC generators
6. Discuss Sensors and Feedback Technology
    - a. List the various types of feedback devices used in industrial controls
    - b. Apply the use of feedback systems in industrial control circuitry including AC, DC, and servo drive systems
    - c. Identify, hardwire, and troubleshoot electro-mechanical devices and electrical switching devices including proximity switches, infra-red, and magnetic sensors
7. Set up/Program PLC
    - a. Describe the function and operation of three basic components of programmable controllers
    - b. Revise electrical ladder control diagrams as reference diagrams to be programmed into the user memory of the programmable controller
    - c. Use the programming devices to program, monitor, and edit the programmable controller
    - d. Design and develop programs using standard functions and special standard functions of the programmable controller
    - e. Troubleshoot functional circuits using reference diagram, indication lights, and programming devices
8. Troubleshoot Electrical Devices
    - a. Discuss common methods of troubleshooting electrical systems
    - b. Follow a logical troubleshooting sequence to trace a problem to its origin
        - (1) Read a VOM test meter
        - (2) Read and use an amprobe
        - (3) Use a voltage tester
        - (4) Troubleshoot and repair 220-480 volts
        - (5) Bend conduit
        - (6) Run service from panels
        - (7) Connect electrical service to machines

# THE MAST PILOT PROGRAM CURRICULUM AND COURSE DESCRIPTIONS

After completing the Competency Profile and Technical Workplace Competency Outline for each occupational specialty area, each MAST partner reviewed their existing curricula against the industry-verified skill standards in order to identify a suitable foundation for new pilot training programs. Because each college had to comply with the requirements of its respective college system and appropriate state agency, the resulting pilot curricula for occupational specialty areas tended to vary in format and academic requirements (e.g., some programs were based on the semester system, others on the quarter system). Despite differences in the curricula developed at the partner colleges, each of the pilot programs was designed to achieve the following two goals mandated in the MAST grant proposal:

- Pilot Program: "Conduct a one year pilot program with 25 or more selected applicants at each college or advanced technology center to evaluate laboratory content and effectiveness, as measured by demonstrated competencies and indicators of each program area."

- Student Assessment: "Identify global skills competencies of program applicants both at point of entrance and point of exit for entry level and already-employed technicians."

(Note: All occupational specialty areas were not pilot tested at all Development Centers; however, all partner colleges conducted one or more pilot programs.)

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Included on the following pages is the curriculum listing for the pilot program which was used to validate course syllabi for this occupational specialty area. This curriculum listing included course names and numbers from the college which conducted the pilot program. The curriculum also shows the number of hours assigned to each of the courses (lecture, lab and credit hours). Also included is a description of each of the courses.

# INDUSTRIAL MAINTENANCE TECHNOLOGY
# CURRICULUM

| **1st Quarter** | | Class | Lab | Credit | Contact |
|---|---|---|---|---|---|
| MAT 103 | Algebraic Concepts | 5 | 0 | 5 | 5 |
| ELC 106 | Direct Current Circuits I | 3 | 2 | 4 | 5 |
| IMT 101 | Industrial Maintenance Safety Procedures | 2 | 1 | 2 | 3 |
| IMT 108 | Industrial Mechanics I | 5 | 5 | 7 | 10 |
| CMP 101 | Introduction to Microcomputers | 1 | 4 | 3 | 5 |
| | | 16 | 12 | 21 | 28 |
| **2nd Quarter** | | | | | |
| ENG 101 | English | 5 | 0 | 5 | 5 |
| ELC 109 | Alternating Current I | 3 | 2 | 4 | 5 |
| ELC 110 | Alternating Current II | 3 | 2 | 4 | 5 |
| IMT 128 | Pumps & Piping Systems | 1 | 4 | 2 | 5 |
| IMT 113 | Industrial Hydraulics | 6 | 4 | 8 | 10 |
| | | 18 | 12 | 23 | 30 |
| **3rd Quarter** | | | | | |
| PSY 100 | Interpersonal Relations and Professional Development | 3 | 0 | 3 | 3 |
| IMT 110 | Industrial Mechanics II | 3 | 7 | 6 | 10 |
| IMT 115 | Industrial Pneumatics | 3 | 2 | 4 | 5 |
| ACT 100 | Refrigeration Fundamentals | 3 | 2 | 4 | 5 |
| XXX ### | Elective | - | - | 3 | - |
| | | 12 | 11 | 20 | 23 |
| **4th Quarter** | | | | | |
| WLD 133 | Metal Welding and Cutting Techniques | 2 | 3 | 3 | 5 |
| MCH 109 | Lathe Operations I | 4 | 6 | 7 | 10 |
| IMT 133 | Industrial Maintenance-Mechanical Review | 1 | 4 | 3 | 5 |
| XXX ### | Elective | - | - | 3 | - |
| | | 7 | 13 | 16 | 20 |

# INDUSTRIAL MAINTENANCE TECHNOLOGY
# COURSE DESCRIPTIONS

| | |
|---|---|
| IMT 101 | Industrial Maintenance Safety Procedures (2-1-2) Provides in-depth study of the health and safety practices required for maintenance of industrial production equipment. Topics include: traffic safety, ladder safety, fire safety, safe work in confined spaces, electrical safety, emergency procedures, an introduction to OSHA regulations,. MSDS Right-To-Know Law, hazardous materials safety, and safety equipment. |
| IMT 108 | Industrial Mechanics I (5-5-7) Provides instruction in basic physics concepts applicable to mechanics of industrial production equipment, teaches basic industrial application of mechanical principles with emphasis placed on power transmission and specific mechanical components. Topics include: mechanical tools, fasteners, basic mechanics, lubrication, bearings, and packings and seals. |
| IMT 110 | Industrial Mechanics II (3-7-6) Continues the application of mechanical principles to industrial production equipment with emphasis on power transmission and mechanical components. Emphasis is placed on alignment and tension. Topics include: mechanical drive systems, couplings and alignment,, clutches and brakes, linkage and levers, mechanical troubleshooting, and preventative maintenance. |
| IMT 113 | Industrial Hydraulics (6-4-8) Provides instruction in fundamental concepts and theories for the safe operation of hydraulic components and systems. Topics include: hydraulic theory, suction side of pumps, actuators, valves, pumps/motors, accumulators, symbols and circuitry, types of fluids, filters, servicing safety, preventative maintenance and troubleshooting. |
| IMT 115 | Industrial Pneumatics (3-2-4) Provides instruction in fundamental concepts and theories for the safe operation of pneumatic components and systems. Topics include: pneumatic theory, preventative maintenance, compressors, regulators, pneumatic valves, actuators, servicing safety and troubleshooting. |
| IMT 128 | Pumps and Piping Systems (1-4-2) Provides instruction in the operation of industrial pumps, valves, and piping/delivery systems with emphasis on installation procedures, maintenance and repair. Topics include: pump identification, pump operation, pump installation, maintenance, troubleshooting, piping systems, and installation and repair of piping systems. |
| IMT 133 | Industrial Maintenance-Mechanical Review (1-4-3) Summarizes and integrates all previous CMP, ELC, and IMT courses. Designed to assist Industrial Maintenance Technology students in assembly, troubleshooting, and repair of multi-system machinery and devices. Topics include: electrical, mechanical, and fluidic interfacing in complex and industrial equipment. |

# INDUSTRIAL MAINTENANCE TECHNOLOGY
# SUPPORT COURSES

| | |
|---|---|
| MAT 103 | Algebraic Concepts (5-0-5) Introduces concepts and operations which can be applied to the study of algebra. Topics include: use of variables, manipulation of algebraic expressions, solution of linear and quadratic equations, evaluation and graphing of linear and quadratic functions, and solution of systems of linear equations. Class includes lecture, applications, and homework to reinforce learning. (Prerequisite: MAT 098, Pre-Algebra, or entrance math score) |
| ELC 106 | Direct Current Circuits I (3-2-4) Introduces direct current (DC) concepts and applications. Topics include: fundamental electrical principles and laws; direct current test equipment; series, parallel, and combination circuits; and basic laboratory procedures and safety practices. (Preprequisites: MAT 103, Algebraic Concepts) |
| CMP 101 | Introduction to Microcomputers (1-4-3) Introduces fundamental concepts and operations necessary to utilize microcomputers. Emphasis is placed on basic functions and familiarity with computer use. Topics include: computer terminology; computer operating systems; data storage; file management; equipment care and operation; and an introduction to work processing, database, and spreadsheet application. (Prerequisite: Provisional admission) |
| ENG 101 | English (5-0-5) Emphasizes the development and improvement of written and oral communication abilities. Topics include: analysis of writing techniques used in selected readings, writing practice, editing and proofreading, research skills, and oral presentation skills. Homework assignments reinforce classroom learning. (Prerequisite: ENG 097, English III and RDG 097, Reading III, or the equivalent) |
| ELC 109 | Alternating Current I (3-2-4) Introduces the theory and application of varying sine wave voltages and current. Topics include: AC wave generation, oscilloscope operation, inductance, and capacitance. (Prerequisites/Corequisite: ELC 108, Direct Current Circuits, II, MAT 104, Geometry and Trigonometry, or MAT 105, Trigonometry) |
| ELC 110 | Alternating Current II (3-2-4) Continues development of AC concepts with emphasis on constructing, verifying, and troubleshooting reactive circuits using RLC theory and oscilloscopes. Topics include: simple RLC circuits, AC circuit resonance, passive filters, transformer theory and applications, and non-sinusoidal wave forms. (Prerequisite/Corequisite: ELC 109, Alternating Current II) |
| PSY 100 | Interpersonal Relations and Professional Development (3-0-3) Provides a study of human relations and professional development in today's rapidly changing world to prepare students for living and working in a complex society. Topics include: personal skills required for an understanding of self and others; projecting a professional image; job acquisition skills such as conducting a job search, |

| | |
|---|---|
| | interviewing techniques, job applications, and resume preparation; and desirable job performance skills and attitudes necessary for job retention and advancement. (Prerequisite: Provisional admission) |
| ACT 100 | Refrigeration Fundamentals (3-2-4) Introduces basic concepts and theories of refrigeration. Topics include: the laws of thermodynamics, pressure and temperature relationships, heat transfer, the refrigeration cycle, and safety. |
| WLD 133 | Metal Welding and Cutting Techniques (2-3-3) Provides instruction in the fundamental use of the electric arc welder and the oxyacetylene cutting outfit. Emphasis is placed on safe set up and use of equipment. Topics include: safety practices, arc welding equipment and set up, oxyfuel welding, flame cutting equipment and set up, and welding and cutting procedures. (Prerequisite: Provisional admission) |
| MCH 109 | Lathe Operations I (4-6-7) Provides opportunities for students to develop skill in the sue of bench grinders and lathes. Topics include: lathes, bench grinders, bench grinder operations, lathe calculations, lathe set up, and lathe operations. (Prerequisite: Provisional admission) |

# THE MAST TECHNICAL WORKPLACE COMPETENCY/COURSE CROSSWALK

Upon development of appropriate curricula for the pilot programs, each MAST college began to develop individual course outlines for its assigned specialty area. The skill standards identified in the Competency Profile were cross walked against the technical competencies of the courses in the pilot curriculum. The resulting matrix provided a valuable tool for assessing whether current course content was sufficient or needed to be modified to ensure mastery of entry level technical competencies. Exit proficiency levels for each of the technical competencies were further validated through industry wide surveys both in Texas and across the nation.

The Technical Workplace Competency/Course Crosswalk in the following pages presents the match between industry-identified duties and tasks and the pilot curriculum for . Course titles are shown in columns, duties and tasks in rows. The Exit Level Proficiency Scale, an ascending scale with 5 the highest level of proficiency, includes marked boxes indicating whether the task is covered by the instructor during the course; the numbers 1-5 indicate the degree of attention given to the task and the corresponding proficiency expected on the part of the student. The crosswalk is intended to serve as an aide to other instructional designers and faculty in community college programs across the nation.

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Included on the following pages is the Technical Workplace Competency/Course Crosswalk for the pilot program curriculum. This crosswalk validates the fact that the duties and tasks which were identified by industry as being necessary for entry level employees have been incorporated into the development of the course syllabi.

*Technical Workplace Competencies/Course*

# CROSSWALK

## TECHNICAL COMPETENCY
## INDUSTRIAL MAINTENANCE TECHNOLOGY

| | Algebraic Concepts | Direct Current Circuits I | Indus. Maint. Safety Pro. | Industrial Mechanics I | Intro. to Microcomputers | English | Alternating Current I | Alternating Current II | Pumps & Piping Systems | Industrial Hydraulics | Interpersonal Relations | Industrial Mechanics II | Industrial Pneumatics | Refrigeration Fundamentals | Metal Welding/Cutting Tech. | Lathe Operations I | Industrial Maint.-Mech. Review | | | | EXIT PROFICIENCY LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. PRACTICE SAFETY** | | | | | | | | | | | | | | | | | | | | | |
| A-1 Recognize OSHA requirements | | X | X | X | | | X | X | X | X | | X | X | X | X | X | X | | | | 4 |
| A-2 Demonstrate use of personal protective equipment | | X | X | X | | | X | X | X | X | | X | X | X | X | X | X | | | | 4 |
| **B. APPLY MATHEMATICAL CONCEPTS** | | | | | | | | | | | | | | | | | | | | | |
| B-1 Perform Basic Arithmetic Functions | X | X | | X | | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| B-2 Convert fractions/decimals | X | X | | X | | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| B-3 Convert English to Metric measurement | | X | | X | | | X | X | X | X | | X | X | X | | X | X | | | | 4 |
| B-4 Perform basic algebraic operations | X | X | | | | | X | X | | X | | | | X | X | X | X | | | | 4 |
| B-5 Perform basic trigonometric functions | | | | | | | | X | | | | | | | X | X | X | | | | 2 |
| B-6 Perform basic geometric calculations | | | | | | | | | | | | | | | X | X | X | | | | 2 |
| **C. INTERPRET ENGINEERING DRAWINGS** | | | | | | | | | | | | | | | | | | | | | |
| C-1 Identify the purpose of listed notes and dimensions | | | | | | | X | X | | X | | X | X | X | X | | X | | | | 3 |
| C-2 Identify Basic Layout of Drawings | | | | | | | X | X | | X | | X | X | X | X | | X | | | | 4 |
| C-3 Make a drawing using each of the basic types of drawing listed | | | | | | | X | X | | X | | X | X | X | X | | X | | | | 3 |
| **D. USE MEASURING TOOLS** | | | | | | | | | | | | | | | | | | | | | |
| D-1 Record dimensions using the coarse measuring tools provided | | | | X | | | | | | X | | X | X | X | X | X | X | | | | 4 |
| D-2 Record dimensions using the precision measuring tools provided | | | | | | | | | | | | X | | | | X | X | | | | 3 |
| D-3 Use Metric and English standard of measurement | | | | | | | | | | | | | | X | X | X | X | | | | 3 |
| **E. USE TOOLS** | | | | | | | | | | | | | | | | | | | | | |
| E-1 Identify and use shop hand tools | | X | | X | | | X | X | X | X | | X | X | X | X | X | X | | | | 4 |
| E-2 Identify and use handheld power tools | | X | | X | | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| **F. OPERATE MACHINE TOOLS** | | | | | | | | | | | | | | | | | | | | | |
| F-1 Use and care of pressure tools | | | | | | | | | | | | | | | | X | X | | | | 2 |
| F-2 Use and care for horizontal and vertical band saws | | | | | | | | | | | | | | | | X | X | | | | 3 |
| F-3 Use and care for pedestal grinders | | | | | | | | | | | | | | | X | X | X | | | | 3 |
| F-4 Use and care for surface grinders | | | | | | | | | | | | | | | X | X | X | | | | 3 |
| F-5 Use and care for lathes | | | | | | | | | | | | | | | | X | X | | | | 3 |
| F-6 Use and care for radial arm drill press | | | | X | | | | | | | | X | | | | | X | | | | 3 |
| **G. PERFORM WELDING OPERATION** | | | | | | | | | | | | | | | | | | | | | |
| G-1 Weld with shielded metal arc welding (SMAW) | | | | | | | | | | | | | | | X | | X | | | | 4 |

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*Technical Workplace Competencies/Course*

# CROSSWALK

## TECHNICAL COMPETENCY
## INDUSTRIAL MAINTENANCE TECHNOLOGY

| | Algebraic Concepts | Direct Current Circuits I | Indus. Maint. Safety Pro. | Industrial Mechanics I | Intro. to Microcomputers | English | Alternating Current I | Alternating Current II | Pumps & Piping Systems | Industrial Hydraulics | Interpersonal Relations | Industrial Mechanics II | Industrial Pneumatics | Refrigeration Fundamentals | Metal Welding/Cutting Tech. | Lathe Operations I | Industrial Maint.-Mech. Review | | | | EXIT PROFICIENCY LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G-2 Weld and cut with oxyacetylene | | | | | | | | | | | | | | | X | | X | | | | 4 |
| G-3 Gas soldering | | | | | | | | | | | | | | | X | | X | | | | 3 |
| H. MAINTAIN / TROUBLESHOOT EQUIPMENT AND SYSTEMS | | | | | | | | | | | | | | | | | | | | | |
| H-1 Maintain air conditioning system | | | | | | | | | | | | | | X | | | X | | | | 3 |
| H-2 Maintain pneumatic control circuit | | | | | | | | | X | | | | X | X | | | X | | | | 4 |
| H-3 Maintain centrifugal pumps | | | | | | | | | X | | | | | X | | | X | | | | 3 |
| H-4 Maintain positive displacement pumps | | | | | | | | | X | X | | | | X | | | X | | | | 3 |
| H-5 Maintain gate, globe, ball and plug valves | | | | | | | | | X | X | | | X | X | | | X | | | | 3 |
| H-6 Maintain check valves and relief valves | | | | | | | | | X | X | | | | X | | | X | | | | 3 |
| H-7 Maintain fans & blowers | | | | | | | | | X | | | | | X | | | X | | | | 4 |
| H-8 Maintain hydraulics system | | | | | | | | | | X | | | | | | | X | | | | 3 |
| I. REPAIR POWER TRANSMISSION SYSTEMS | | | | | | | | | | | | | | | | | | | | | |
| I-1 Belt drives | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| I-2 Gear drives | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| I-3 Chain drives | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| J. FABRICATE / INSTALL SHEET METAL PARTS | | | | | | | | | | | | | | | | | | | | | |
| J-1 Layout sheet metal parts | | | | | | | | | | | | | | X | | | X | | | | 3 |
| J-2 Form/bend sheet metal parts | | | | | | | | | | | | | | X | | | X | | | | 3 |
| J-3 Fasten sheet metal parts | | | | | | | | | | | | | | X | | | X | | | | 3 |
| K. PIPEFITTING OPERATIONS | | | | | | | | | | | | | | | | | | | | | |
| K-1 Perform basic pipefitting calculations | | | | | | | | | | | | | | | X | | X | | | | 4 |
| K-2 Cut and thread pipe using hand operated pipe cutter, reamer and die | | | | | | | | | | | | | | | X | | X | | | | 4 |
| K-3 Assemble pipe with threaded flanges | | | | | | | | | | | | | | | X | | X | | | | 4 |
| K-4 Instal and adjust pipe support | | | | | | | | | | | | | | | X | | X | | | | 4 |
| K-5 Use flairing equipment | | | | | | | | | | | | | | | X | | X | | | | 4 |
| K-6 Bend metal tubing | | | | | | | | | | | | | | | X | | X | | | | 4 |
| K-7 Join plastic pipe using cement | | | | | | | | | | | | | | | | | X | | | | 4 |
| L. BASIC RIGGING | | | | | | | | | | | | | | | | | | | | | |
| L-1 Rigging Fundamentals | | | | | | | | | | | | X | | | | | X | | | | 4 |
| L-2 Demonstrate basic rigging skills | | | | | | | | | | | | X | | | | | X | | | | 4 |

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# *Technical Workplace Competencies/Course*
# CROSSWALK

## TECHNICAL COMPETENCY
## INDUSTRIAL MAINTENANCE TECHNOLOGY

| | Algebraic Concepts | Direct Current Circuits I | Indus. Maint. Safety Pro. | Industrial Mechanics I | Intro. to Microcomputers | English | Alternating Current I | Alternating Current II | Pumps & Piping Systems | Industrial Hydraulics | Interpersonal Relations | Industrial Mechanics II | Industrial Pneumatics | Refrigeration Fundamentals | Metal Welding/Cutting Tech. | Lathe Operations I | Industrial Maint.-Mech. Review | | | | EXIT PROFICIENCY LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **M. OPERATE HOISTING EQUIPMENT** | | | | | | | | | | | | | | | | | | | | | |
| M-1 Demonstrate proper use of hoisting equipment | | | | | | | | | | | | X | | | | | X | | | | 4 |
| **N. BEARING MAINTENANCE** | | | | | | | | | | | | | | | | | | | | | |
| N-1 Remove and install a journal bearing | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| N-2 Remove and install an anti-friction (roller) bearings | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| N-3 Install and remove a thrust bearing | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| N-4 Identify typical cause of bearing failure | | | | | | | | | | | | X | | | | | X | | | | 4 |
| N-5 Gather vibration analysis data | | | | | | | | | X | | | X | | | | | X | | | | 4 |
| **O. USE COMPUTERS** | | | | | | | | | | | | | | | | | | | | | |
| O-1 Perform basic word processing | | | | | X | | | | | | | | | | | | X | | | | 2 |
| O-2 Perform basic spreadsheet operations | | | | | X | | | | | | | | | | | | X | | | | 2 |
| **P. ALIGN SHAFTS** | | | | | | | | | | | | | | | | | | | | | |
| P-1 Define terms relative to shaft alignment | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| P-2 Perform alignments using feeler gauges and straight edge | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| P-3 Perform alignment using single and reverse indicators | | | | X | | | | | | | | X | | | | | X | | | | 4 |
| **Q. INSTALL / ALIGN MACHINES** | | | | | | | | | | | | | | | | | | | | | |
| Q-1 Install electrical connections | | X | | | | | X | X | | | | | | X | | | X | | | | 3 |
| Q-2 Perform required pipefitting task | | | | | | | | | X | | | | | | | | X | | | | 2 |
| Q-3 Grout as necessary | | | | | | | | | X | | | | | | | | X | | | | 2 |
| Q-4 Describe mounting methods | | | | X | | | | X | | | | X | | | | | X | | | | 2 |
| Q-5 Level and align machine components | | | | | | | | | | | | X | | | | | X | | | | 4 |
| Q-6 Use a stud gun | | | | | | | | X | | | | | | | | | X | | | | 2 |
| Q-7 Perform electrical and pneumatic drilling operations | | | | | | | | X | | | | | X | | | | X | | | | 2 |
| **R. MAINTAIN ELECTRICAL DEVICES** | | | | | | | | | | | | | | | | | | | | | |
| R-1 Use electrical test equipment | | X | | | | | X | X | | | | | | | | | X | | | | 4 |
| R-2 Apply specific terms to electrical circuits | | X | | | | | X | X | | | | | | | | | X | | | | 3 |
| R-3 Analyze series, parallel and complex circuits | | | | | | | | X | | | | | | | | | X | | | | 3 |
| R-4 Check AC & DC motors for proper operation | | X | | | | | X | X | | | | | | | | | X | | | | 3 |
| R-5 Troubleshoot electrical devices | | X | | | | | X | X | | | | | | | | | X | | | | 4 |
| | | | | | | | | | | | | | | | | | | | | | |

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# INDUSTRIAL MAINTENANCE MECHANIC
# TECHNICAL WORKPLACE COMPETENCIES
# EXIT LEVEL PROFICIENCY MATRIX

| | |
|---|---|
| Industrial Maintenance Mechanic: | uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, and/or install equipment/machinery used in industry. |

The following matrix identifies the five exit levels of technical workplace competencies for the Industrial Maintenance Mechanic Certificate at Augusta Technical Institute, Augusta, Georgia.

| EXIT LEVEL OF PROFICIENCY | | | | | |
|---|---|---|---|---|---|
| **Technical Workplace Competency** | **1** | **2** | **3** | **4** | **5** |
| | rarely | routinely with supervision | routinely with limited supervision | routinely without supervision | initiates/ improves/ modifies and supervises others |

# THE MAST SCANS/COURSE CROSSWALK

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The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in its "AMERICA 2000 REPORT' the following five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance:

**COMPETENCIES:**

Resources: Identifies, organizes, plans, and allocates resources
Interpersonal: Works with others
Information: Acquires and uses information
Systems: Understands complex inter-relationships
Technology: Works with a variety of technologies

**FOUNDATION SKILLS:**

Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks
Thinking Skills: Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons
Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty

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Recognizing the value of SCANS proficiencies to job performance, as well as the growing mandate in many states to include SCANS activities in course curricula, MAST asked survey respondents to review the SCANS skill sets in the context of the draft skill standards for each occupational specialty area. MAST also incorporated evaluation of SCANS competencies and foundation skills into its assessment of the pilot training curricula. The results were summarized in a crosswalk that allowed MAST staff to modify course content where needed to strengthen achievement of SCANS competencies.

The following pages present the SCANS/Course Crosswalk for the pilot curriculum in Courses are listed along the top and SCANS competencies and foundations are shown along the left side of the matrix. An exit level proficiency matrix for SCANS competencies and foundation skills is provided as well.

As "soft" skills, the SCANS competencies are inherently difficult to quantify. MAST realizes that some faculty will emphasize the SCANS more or less than others. The SCANS/Course Crosswalk matrix has been included with this course documentation to show the importance of these "soft skills" and the importance of their being addressed in the classroom (particularly in technical classes). In time, faculty will learn to make these types of SCANS activities an integral and important part of the teaching process.

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Included on the following pages is the SCANS/Course Crosswalk for the pilot program curriculum. This crosswalk validates the fact that the "soft skills" (SCANS) which were identified by industry as being necessary for entry level employees have been incorporated into the development of the course syllabi. Also included is a matrix which defines the exit level of proficiency scale (1-5).

Page 1

*SCANS/Course*

# CROSSWALK

## INDUSTRIAL MAINTENANCE TECHNICIAN

| COMPETENCY | Algebraic Concepts | Direct Current Circuits I | Indus. Maint. Safety Pro. | Industrial Mechanics I | Intro. to Microcomputers | English | Alternating Current I | Alternating Current II | Pumps & Piping Systems | Industrial Hydraulics | Interpersonal Relations | Industrial Mechanics II | Industrial Pneumatics | Refrigeration Fundamentals | Metal Welding/Cutting Tech. | Lathe Operations I | Industrial Maint.-Mech. Review | | | | EXIT PROFICIENCY LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **(RS) RESOURCES:** | | | | | | | | | | | | | | | | | | | | | |
| A. Allocates time | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 4 |
| B. Allocates money | | | X | | | | | | X | X | | X | | X | | | X | | | | 2 |
| C. Allocates material and facility resources | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| D. Allocates human resources | | X | X | X | X | | X | X | X | X | X | X | X | X | X | | X | | | | 3 |
| **(IN) INTERPERSONAL SKILLS:** | | | | | | | | | | | | | | | | | | | | | |
| A. Participates as a member of a team | | X | X | | X | | X | X | | X | X | X | | X | X | X | X | | | | 3 |
| B. Teaches others | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| C. Serves clients/customers | | X | | | | | | | | X | X | | X | X | X | X | X | | | | 2 |
| D. Exercises leadership | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 4 |
| E. Negotiates | | | | | | | | | | | | | | | X | | | | | | 2 |
| F. Works with cultural diversity | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 4 |
| **(IF) INFORMATION SKILLS:** | | | | | | | | | | | | | | | | | | | | | |
| A. Acquires and evaluates information | X | X | X | X | X | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| B. Organizes and maintains information | X | X | X | X | X | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| C. Interprets and communicates information | X | X | X | X | X | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| D. Uses computers to process information | | | | | X | | | | | | | | | | | | | | | | 2 |
| **(SY) SYSTEMS:** | | | | | | | | | | | | | | | | | | | | | |
| A. Understands systems | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 4 |
| B. Monitors and corrects performance | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| C. Improves and designs systems | X | | | | | | | | | | X | | X | X | X | X | X | | | | 3 |
| **(TE) TECHNOLOGY:** | | | | | | | | | | | | | | | | | | | | | |
| A. Selects technology | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 4 |
| B. Applies technology to task | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| C. Maintains and troubleshoots technology | X | | X | X | | | X | X | X | X | X | X | X | X | X | X | X | | | | 4 |

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*SCANS/Course*

# CROSSWALK

## INDUSTRIAL MAINTENANCE TECHNICIAN

| FOUNDATION SKILLS | Algebraic Concepts | Direct Current Circuits I | Indus. Maint. Safety Pro. | Industrial Mechanics I | Intro. to Microcomputers | English | Alternating Current I | Alternating Current II | Pumps & Piping Systems | Industrial Hydraulics | Interpersonal Relations | Industrial Mechanics II | Industrial Pneumatics | Refrigeration Fundamentals | Metal Welding/Cutting Tech. | Lathe Operations I | Industrial Maint.-Mech. Review | | | | EXIT PROFICIENCY LEVEL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **(BS) BASIC SKILLS:** | | | | | | | | | | | | | | | | | | | | | |
| A. Reading | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| B. Writing | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| C. Arithmetic and mathematics | X | | X | | | | | | | X | X | X | X | X | X | X | X | | | | 4 |
| D. Listening | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 4 |
| E. Speaking | | | | | | | | | | | X | | | | | | X | | | | 2 |
| | | | | | | | | | | | | | | | | | | | | | |
| **(TS) THINKING SKILLS:** | | | | | | | | | | | | | | | | | | | | | |
| A. Creative thinking | | | | | | | | | | | | | | | X | X | X | | | | 2 |
| B. Decision making | | | | | | | | | | | | | | | | | X | | | | 3 |
| C. Problem solving | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 2 |
| D. Seeing things in the mind's eye | X | X | X | X | X | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| E. Knowing how to learn | X | X | X | X | X | | X | X | X | X | | X | X | X | X | X | X | | | | 3 |
| F. Reasoning | X | X | X | X | X | | X | X | X | X | | X | X | X | X | X | X | | | | 4 |
| | | | | | | | | | | | | | | | | | | | | | |
| **(PQ) PERSONAL QUALITIES:** | | | | | | | | | | | | | | | | | | | | | |
| A. Responsibility | | X | X | X | | | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| B. Self-esteem | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| C. Social | | | | | | | X | | | | | X | | | | | X | | | | 3 |
| D. Self-management | X | X | X | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | | 3 |
| E. Integrity/honesty | | | | | | | | | | | | | | | | | X | | | | 3 |

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# SCANS
## COMPETENCIES AND FOUNDATION SKILLS
## EXIT LEVEL PROFICIENCY MATRIX

The Secretary's Commission on Achieving Necessary Skills (SCANS), U. S. Department of Labor, has identified in it's "AMERICA 2000 REPORT' the following five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance:

**COMPETENCIES:**

| | |
|---|---|
| Resources: | Identifies, organizes, plans, and allocates resources |
| Interpersonal: | Works with others |
| Information: | Acquires and uses information |
| Systems: | Understands complex inter-relationships |
| Technology: | Works with a variety of technologies |

**FOUNDATION SKILLS:**

| | |
|---|---|
| Basic Skills: | Reads, writes, performs arithmetic and mathematical operations, listens and speaks |
| Thinking Skills: | Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons |
| Personal Qualities: | Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty. |

The following matrix identifies the five exit levels of proficiency that are needed for solid job performance.

| EXIT LEVEL OF PROFICIENCY | | | | | |
|---|---|---|---|---|---|
| **SCANS Competencies and Foundation Skills** | **1** | **2** | **3** | **4** | **5** |
| | rarely | routinely with supervision | routinely with limited supervision | routinely without supervision | initiates/ improves/ modifies and supervises others |

# THE MAST COURSE SYLLABI
# "PILOT PROGRAM"

MAST has produced a very unique set of course outlines, driven and validated by industry and encompassing the broad range of technologies covered by the MAST grant. The course outlines also include proposed SCANS activities that will be useful to an instructor in preparing students to enter the workforce of the future.

Included in the following pages are final course outlines developed and refined in the process of piloting the MAST training programs. The outlines include a brief course description; required course materials (e.g., textbook, lab manual, and tools, if available); proposed method of instruction; proposed lecture and lab outlines; and detailed course objectives for both Technical Workplace Competencies and SCANS Competencies.

These outlines were completed and revised during the second year of MAST, following completion of the pilot phase. The outlines are intended to serve as an aide to other instructional designers and faculty in community college programs across the nation.

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Included on the following pages are the Course Syllabi for each of the courses which were taught during the pilot program.

**Machine Tool Advanced Skills**
**Technology Program**

**MAST**

# COURSE SYLLABUS
# ALGEBRAIC CONCEPTS
**Prerequisite: PRE-ALGEBRA**

# MAST PROGRAM
## COURSE SYLLABUS
## ALGEBRAIC CONCEPTS

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**Lecture hours/week: 5** **Lab hours/week: 0** **Credit hours: 5**

### COURSE DESCRIPTION:

Introduces concepts and operations which can be applied to the study of algebra. Course content emphasizes: use of variable, manipulation of algebraic expressions, solution of linear and quadratic equations, evaluation and graphing of linear and quadratic functions, and solution of systems of linear equations. Class includes lecture, applications, and homework to reinforce learning.

**PREREQUISITE:** Pre-Algebra, or entrance math scores in accordance with approved DTAE admission score levels

### REQUIRED COURSE MATERIALS:

**Textbook:** Introduction to Technical Mathematics, Washington, A. J., & Triola, M. F. (4th ed., 1988), Menlo Park, CA: Benjamin Cummings

**Materials:**
Scientific calculator
Graph paper
Pencils
Straight edge

### METHODS OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture and discussions.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. satisfactorily perform on written, oral, and practical examinations
2. satisfactorily perform on outside assignments including writing assignments
3. contribute to class discussions
4. maintain attendance per current policy

### LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Arithmetic Operations and Order of Operations | Chapter 1 | |

| | | |
|---|---|---|
| Units of Measurement and Approximate Numbers | Chapters 2-3 | |
| Signed numbers | | |
| TEST 1 | | |
| Exponents, Roots, and Radicals | Chapter 10 | |
| Introduction to Algebra, Simple Equations and Inequalities | Chapters 4-5 | |
| Basic Algebraic Operations | Chapter 7 | |
| TEST 2 | | |
| Factoring | Chapter 8 | |
| Algebraic Operations | Chapter 9 | |
| Quadratic Equations | Chapter 11 | |
| TEST 3 | | |
| Graphs | Chapter 13 | |
| Simultaneous Linear Equations | Chapter 14 | |
| TEST 5 | | |
| FINAL EXAM - Cumulative | | — |
| | **Total Lecture Hours** | |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
   1. Perform Basic Algebraic Operations

B. **SOLVE PROBLEMS WITH ARITHMETIC NUMBERS**
   1. Calculate Sums, Differences, Products, Quotients, Powers and Root Using Arithmetic Numbers, Scientific Notation and Order of Operations
   2. Convert Radicals to Simplest Form and Use Them in Arithmetic Operations
   3. Solve Arithmetic Problems Using a Scientific Calculator

C. **SOLVE PROBLEMS USING BASIC ALGEBRAIC CONCEPTS**
   1. Calculate Sums, Difference, Products, Quotients, Powers, and Roots Using Integers, Absolute Value, and Order of Operations
   2. Calculate Sums, Differences, Products, Quotients, Powers and Factors Using Polynomials and Algebraic Fractions
   3. Solve and Apply Equations--linear, Quadratic, Fractional and Formula--by Use of Properties of Equality, Factoring, and Quadratic Formula

D. **SOLVE PROBLEMS USING INTERMEDIATE ALGEBRAIC CONCEPTS**
   1. Convert an Expression to a Linear or Quadratic Function by Expressing One Variable as a Function of Another and Evaluate the Function for Specific Values of the Independent Variable
   2. Translate a Function into a Linear or Quadratic Graph and Solve Applied Problems Using These Functions
   3. Solve Systems of Linear Equations with 2 or 3 Variables Using Elimination, Substitution, Graphing, and Determinants

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

### I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
  1. follows a schedule to complete assigned tasks on time
  2. determine the initial cost of materials and "value added" as result of work
  3. complete a stock request form for required material
  4. provide a self-evaluation of performance based on the time and quality of work
- *B.* ***Interpersonal:*** *Works with others*
  1. complete assigned responsibilities within the shop floor serving as a member of the team
  2. provide individual assistance/direction to peers as requested
  3. perform work to acceptable levels of quality as required
  4. works well with all members of the class
- *C.* ***Information:*** *Acquires and uses information*
  1. read and interpret blueprints
  2. organize and apply theories of machine tool operation
  3. perform basic semi-precision and precision layout as necessary
- *D.* ***Systems:*** *Understands complex inter-relationships*
  1. demonstrate knowledge of the following systems
     - a. laboratory organization structure: physical and social
     - b. organization of personnel and facilities on the shop floor
     - c. systematic approach to the mechanical process
     - d. dimensioning and measurement systems
     - e. systematic organization of training materials
  2. monitors and corrects performance during
     - a. the practical process
     - b. adjustments of individual laboratory work schedule
     - c. constantly evaluating the quality of work to achieve acceptable standards
     - d. maintains record of evaluations and sets individual goals
- *E.* ***Technology:*** *Works with a variety of technologies*
  1. chooses procedure, tools and equipment required to perform the task
  2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards

3. maintains and troubleshoots equipment
    a. applies appropriate preventative maintenance
    b. when operating machines
    c. reports all malfunctions of equipment to supervisor/instructor
    d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

*A.* ***Basic Skills:*** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.

- *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    - a. studies student laboratory manual
    - b. interprets blueprints and technical drawings
    - c. read/studies textbook
    - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
- *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    - a. outline the steps necessary to perform a mechanical task
    - b. maintain a lecture notebook
    - c. submit written responses to chapter question assignments
    - d. complete all written assignments
- *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    - a. keeps a running computation of individual grade
    - b. performs mathematical computations necessary to understand course
- *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    - a. assimilate classroom instruction
    - b. interpret and assimilate video instruction
    - c. observe laboratory demonstrations
    - d. seek and receive individualized instruction in the laboratory
- *5.* ***Speaking:*** *Organizes ideas and communicates orally*
    - a. participates in classroom discussions
    - b. organize ideas and communicate specific questions to the instructor
    - c. verbally affirms understanding of a concept, procedure, or required skill
    - d. communicates with peers to ensure the smooth and safe operation of the laboratory

*B.* ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

- *1.* ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*

        a. identifies personal goals
        b. identifies actions required to accomplish personal goals
    2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
        a. makes daily accommodations to stay on schedule
        b. seeks additional instruction/clarification for assignment completion
        c. balances social and academic life/responsibilities
        d. accepts responsibility
    3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
        a. interprets technical drawings
        b. interprets technical illustrations and symbols
        c. understands both written and verbal instructions
        d. assimilates process during instructor demonstrations
    4. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
        a. demonstrate mastery of the basic skills and techniques
        b. use these sequential skills to support mastery of new skills
        c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
    5. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
        a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
        b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
        c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:*** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.
    1. ***Responsibility:** Exerts a high level of effort and perseveres towards goal attainment*
        a. develops an understanding that in order to be successful you must be a "good" student
        b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
        c. develops an understanding good students know what they are going to do in class and does not waste time
        d. develops a fine work-ethic
    2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
        a. learns to take pride in his or her work through positive reinforcement
        b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal

   c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   a. assist classmates in improving technical skills
   b. assist students with special needs as a peer mentor
   c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   a. maintain a record of academic achievement (individual grade book)
   b. make accommodations to laboratory schedules due to broken equipment/tools
   c. accept the responsibility for self-management
5. ***Integrity/Honesty:** Chooses ethical courses of action*
   a. accept the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
   d. understand the consequences of unethical behaviors

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

# MAST

## COURSE SYLLABUS

# DIRECT CURRENT CIRCUITS I

# MAST PROGRAM
## COURSE SYLLABUS
## DIRECT CURRENT CIRCUITS I

---

**Lecture hours/week: 3** **Lab hours/week: 2** **Credit hours: 4**

**COURSE DESCRIPTION:**

Introduces direct current concepts and applications. Topics include: Fundamental electrical principles and laws; Direct current test equipment; Series, parallel, and combination circuits; and basic laboratory and safety practices.

**PREREQUISITE: NONE**

**REQUIRED COURSE MATERIALS:**

**Textbook:** Electricity 1, Kubala, Delmar Publishing Co.

**Hand Tools/Quantity Required:**
Calculator
Tool box
Volt-Ohm meter
Safety shoes
Classroom supplies
Safety glasses

**METHODS OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

**LECTURE OUTLINE:**

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Review Basic Math<br>Electron Theory and Ohm's Law<br>Test 1 | Chapters 1-3 | 3 |
| Energy and Power<br>Circuits, Symbols and Diagrams<br>Test 2 | Chapter 4 | 3 |
| Measuring Electricity<br>Series Circuits<br>Test 3 | Chapter 5 | 3 |
| Parallel Circuits<br>Test 4 | Chapter 6 | 3 |
| Series-Parallel Circuits<br>Unit 10 Review<br>Test 5 | Chapters 7-9 | 3 |
| Conductors and Wire Sizes<br>Voltage Drop<br>Test 6 | Chapters 11-13 | 3 |
| Batteries; Magnetics<br>Unit 15 Review<br>Test 7 | Chapter 14 | 3 |
| DC Motors - Shunt, Series<br>Test 8 | Chapters 16-17 | 3 |
| DC Motors - Compound<br>Test 9<br>Unit 20 | Chapters 18-19 | 3 |
| Final Review; Final Exam | | 3 |
| | **Total Lecture Hours** | **30** |

**LAB OUTLINE:**

| Lab Topics | Contact Hrs. |
|---|---|
| Ohm's Law Problems | 2 |
| Circuit with Source and Load | 2 |
| Series Circuits-Build and Measure Voltages and Circuits | 2 |
| Parallel Circuits-Build and Measure, Voltages and Currents | 2 |
| Series-Parallel Circuit-Build and Measure, Voltages and Currents | 2 |
| Voltage Drop Circuit | 2 |
| Charge and Test Battery | 2 |
| Wire and Run Shunt and Series Motor | 2 |
| Wire and Run Compound Motor | 2 |
| Complete all Labs | 2 |
| **Total Lab Hours** | **20** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
   1. Recognize OSHA Requirements
   2. Demonstrate Use of Personal Protective Equipment

B. **APPLY MATHEMATICAL CONCEPTS**
   1. Perform Basic Arithmetic Functions
      a. Add, subtract, multiply, divide whole numbers
      b. Add, subtract, multiply, divide fractions
      c. Add, subtract, multiply, divide decimal numbers
   2. Convert Fractions /Decimals
   3. Convert English to Metric Measurement
      a. Use English to Metric conversion chart
      b. Perform calculations to convert English to Metric measurement
   4. Perform Basic Algebraic Operations
   5. Perform Basic Trigonometric Functions

C. **USE TOOLS**
   1. Identify and Use Shop Hand Tools
      a. Use and care of wrenches
      b. Use and care of screwdrivers
      c. Use and care of pliers and cutters
      d. Use and care of striking tools
      e. Use and care of bearing pullers
      f. Use and care of threading and reaming equipment
      g. Use and care of files
   2. Identify and Use Hand Held Power Tools
      a. Use and care portable grinders
      b. Use and care of portable drill motors
      c. Use and care of portable band saws
      d. Use and care of portable reciprocating saws

D. **MAINTAIN ELECTRICAL DEVICES**
   1. Use Electrical Test Equipment
   2. Apply Specific Terms to Electrical Circuits

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

---

The following activities will be performed by each student for successful completion of this course:

## I. COMPETENCIES

- A. *Resources: Identifies, organizes, plans, and allocates resources*
  1. follows a schedule to complete assigned tasks on time
  2. determine the initial cost of materials and "value added" as result of work
  3. complete a stock request form for required material
  4. provide a self-evaluation of performance based on the time and quality of work
- B. *Interpersonal: Works with others*
  1. complete assigned responsibilities within the shop floor serving as a member of the team
  2. provide individual assistance/direction to peers as requested
  3. perform work to acceptable levels of quality as required
  4. works well with all members of the class
- C. *Information: Acquires and uses information*
  1. read and interpret blueprints
  2. organize and apply theories of machine tool operation
  3. perform basic semi-precision and precision layout as necessary
- D. *Systems: Understands complex inter-relationships*
  1. demonstrate knowledge of the following systems
     - a. laboratory organization structure: physical and social
     - b. organization of personnel and facilities on the shop floor
     - c. systematic approach to the mechanical process
     - d. dimensioning and measurement systems
     - e. systematic organization of training materials
  2. monitors and corrects performance during
     - a. the practical process
     - b. adjustments of individual laboratory work schedule
     - c. constantly evaluating the quality of work to achieve acceptable standards
     - d. maintains record of evaluations and sets individual goals
- E. *Technology: Works with a variety of technologies*
  1. chooses procedure, tools and equipment required to perform the task
  2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
  3. maintains and troubleshoots equipment
     - a. applies appropriate preventative maintenance
     - b. when operating machines
     - c. reports all malfunctions of equipment to supervisor/instructor
     - d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

- A. *Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    a. studies student laboratory manual
    b. interprets blueprints and technical drawings
    c. read/studies textbook
    d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    a. outline the steps necessary to perform a mechanical task
    b. maintain a lecture notebook
    c. submit written responses to chapter question assignments
    d. complete all written assignments
3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    a. keeps a running computation of individual grade
    b. performs mathematical computations necessary to understand course
4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. assimilate classroom instruction
    b. interpret and assimilate video instruction
    c. observe laboratory demonstrations
    d. seek and receive individualized instruction in the laboratory
5. ***Speaking*:** *Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor
    c. verbally affirms understanding of a concept, procedure, or required skill
    d. communicates with peers to ensure the smooth and safe operation of the laboratory

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. identifies personal goals
    b. identifies actions required to accomplish personal goals
2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
    a. makes daily accommodations to stay on schedule
    b. seeks additional instruction/clarification for assignment completion
    c. balances social and academic life/responsibilities
    d. accepts responsibility
3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*

    a. interprets technical drawings
    b. interprets technical illustrations and symbols
    c. understands both written and verbal instructions
    d. assimilates process during instructor demonstrations
  4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of the basic skills and techniques
    b. use these sequential skills to support mastery of new skills
    c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
  5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
    b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
    c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
  1. ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work-ethic
  2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
  3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. share laboratory resources (machines, tools and instructor's individual attention)
  4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*

    a. maintain a record of academic achievement (individual gradebook)
    b. make accommodations to laboratory schedules due to broken equipment/tools
    c. accept the responsibility for self-management

5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accept the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
    d. understand the consequences of unethical behaviors

*M*achine Tool *A*dvanced *S*kills
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MAST

# COURSE SYLLABUS

# INDUSTRIAL MAINTENANCE SAFETY PROCEDURES

# MAST PROGRAM
## COURSE SYLLABUS
## INDUSTRIAL MAINTENANCE SAFETY PROCEDURES

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**Lecture hours/week: 2** **Lab hours/week: 1** **Credit hours: 2**

**COURSE DESCRIPTION:**

Provides in-depth study of the health and safety practices required for maintenance of industrial production equipment. Topics include: traffic safety, ladder safety, fire safety, safe work in confined spaces, electrical safety, emergency procedures, an introduction to OSHA regulations,. MSDS Right-To-Know Law, hazardous materials safety, and safety equipment.

**PREREQUISITE: none**

**REQUIRED COURSE MATERIALS:**

**Textbook:** Safety & Health, School Craft Publishing

**Hand Tools/Quantity Required:**

| | |
|---|---|
| Safety Glasses | 1 pair |
| Classroom Supplies | 1 |
| Calculator | 1 |

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

**LECTURE OUTLINE:**

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Information Sheet 100-1 "Safety First" | | |
| "Introduction to Safety" | Chapter 1 | 2 |
| Video 101-1 - Introduction to Safety | | |
| Lab 1 | | |
| TEST ONE | | |
| "Safety Laws" | Chapter 2 | 2 |
| Video 101-3 - Government Safety Regulations | | |
| Video 101-4 - OSHA "Permit-Required Confined Spaces" | | |
| Lab 2 | | |
| TEST TWO | | |
| "Personal Protective Equipment" | Chapter 3 | 2 |
| Video 101-5 - Personal Protective Equipment | | |
| Video 101-6 - Selection and Use of Personal Protective Equipment | | |
| Video 101-7 - Eye Care and Safety | | |
| Lab 3 | | |
| TEST THREE | | |
| "Chemical Safety" | Chapter 4 | 2 |
| "Tool Safety" | Chapter 5 | |
| Video 101-8 - Hand & Power Tool Safety | | |
| "Safe Material Handling" | Chapter 6 | |
| TEST FOUR, FIVE, SIX | | |
| Review all lesson material | | 2 |
| MIDTERM EXAM | | |
| "Machine Safety" | Chapter 7 | |
| Video 101-19 - Lock-Out and Tag-Out | | |
| Lab 4 | | |
| TEST SEVEN | | |
| "Electrical Safety" | Chapter 8 | 2 |
| Video 101-17 - Our Invisible Friend Electricity | | |
| Video 101-18 - Electricity Safety | | |
| "Electrical Protection" | Chapter 9 | |
| Lab 5 | | |
| TESTS EIGHT AND NINE | | |
| "Fire Protection" | Chapter 10 | 2 |
| Video 101-20 - Fire Protection | | |
| Handout 101-2 - Types of Fire Extinguishers | | |
| Lab 6 | | |

| | | |
|---|---|---|
| TEST TEN | | |
| "Health Protection" | Chapter 11 | 2 |
| Video 101-9 - Hand, Wrist and Finger Safety | | |
| Video 101-13 - Back Care and Safety | | |
| Lab 7 | | |
| TEST ELEVEN | | |
| "Safe Work Practices" | Chapter 12 | 2 |
| Video 101-10 - Working Safely | | |
| Video 101-2 - Safety Attitudes and Practices | | |
| Lab 8 | | |
| TEST TWELVE | | |
| Complete ALL assignments | | 2 |
| Review ALL LESSONS | | |
| FINAL EXAM | | |
| | **Total Lecture Hours** | **20** |

**LAB OUTLINE:**

| Lab Topics | Contact Hrs. |
|---|---|
| Lab 1 | |
| Lab 2 | |
| Lab 3 | |
| None | |
| Lab 4 | |
| Lab 5 | |
| Lab 6 | |
| Lab 7 | |
| Lab 8 | |
| None | |
| **Total Lab Hours** | **10** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
  1. Follow Safety Manuals and All Safety Regulations/Requirements
     a. Assume responsibility for the personal safety of oneself and others
     b. Develop a personal attitude towards safety
     c. Interpret safety manual directives
     d. Comply with established company safety practices
  2. Use Protective Equipment
     a. Wear protective safety clothing as required
     b. Maintain and use protective guards and equipment on machinery
     c. Locate and properly use protective equipment

        - d. Use lifting aids when necessary
    3. Follow Safe Operating Procedures for Hand and Machine Tools
        - a. Identify and understand safe machine operating procedures
        - b. Demonstrate safe machine operation
    4. Maintain a Clean and Safe Work Environment
        - a. Keep work areas clean
        - b. Clean machine/hand tools when work is completed
        - c. Put tools away when work is finished
        - d. Keep aisles clear of equipment and materials

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

### I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. determine the initial cost of materials and "value added" as result of work
    3. complete a stock request form for required material
    4. provide a self-evaluation of performance based on the time and quality of work
- *B.* ***Interpersonal:*** *Works with others*
    1. complete assigned responsibilities within the shop floor serving as a member of the team
    2. provide individual assistance/direction to peers as requested
    3. perform work to acceptable levels of quality as required
    4. works well with all members of the class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and interpret blueprints
    2. organize and apply theories of machine tool operation
    3. perform basic semi-precision and precision layout as necessary
- *D.* ***Systems:*** *Understands complex inter-relationships*
    1. demonstrate knowledge of the following systems
        - a. laboratory organization structure: physical and social
        - b. organization of personnel and facilities on the shop floor
        - c. systematic approach to the mechanical process
        - d. dimensioning and measurement systems
        - e. systematic organization of training materials

2. monitors and corrects performance during
   a. the practical process
   b. adjustments of individual laboratory work schedule
   c. constantly evaluating the quality of work to achieve acceptable standards
   d. maintains record of evaluations and sets individual goals

*E.* ***Technology:*** *Works with a variety of technologies*
1. chooses procedure, tools and equipment required to perform the task
2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
3. maintains and troubleshoots equipment
   a. applies appropriate preventative maintenance
   b. when operating machines
   c. reports all malfunctions of equipment to supervisor/instructor
   d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

*A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

*1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
   a. studies student laboratory manual
   b. interprets blueprints and technical drawings
   c. read/studies textbook
   d follow a daily laboratory schedule to maintain appropriate time-line and task completion

*2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
   a. outline the steps necessary to perform a mechanical task
   b. maintain a lecture notebook
   c. submit written responses to chapter question assignments
   d. complete all written assignments

*3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
   a. keeps a running computation of individual grade
   b. performs mathematical computations necessary to understand course

*4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
   a. assimilate classroom instruction
   b. interpret and assimilate video instruction
   c. observe laboratory demonstrations
   d. seek and receive individualized instruction in the laboratory

*5.* ***Speaking***: *Organizes ideas and communicates orally*

   - a. participates in classroom discussions
   - b. organize ideas and communicate specific questions to the instructor
   - c. verbally affirms understanding of a concept, procedure, or required skill
   - d. communicates with peers to ensure the smooth and safe operation of the laboratory

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
   - a. identifies personal goals
   - b. identifies actions required to accomplish personal goals

2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
   - a. makes daily accommodations to stay on schedule
   - b. seeks additional instruction/clarification for assignment completion
   - c. balances social and academic life/responsibilities
   - d. accepts responsibility
3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
   - a. interprets technical drawings
   - b. interprets technical illustrations and symbols
   - c. understands both written and verbal instructions
   - d. assimilates process during instructor demonstrations
4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
   - a. demonstrate mastery of the basic skills and techniques
   - b. use these sequential skills to support mastery of new skills
   - c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
   - a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
   - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
   - c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
   - a. develops an understanding that in order to be successful you must be a "good" student

- b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
- c. develops an understanding good students know what they are going to do in class and does not waste time
- d. develops a fine work-ethic

2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
   - a. learns to take pride in his or her work through positive reinforcement
   - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   - a. assist classmates in improving technical skills
   - b. assist students with special needs as a peer mentor
   - c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   - a. maintain a record of academic achievement (individual grade book)
   - b. make accommodations to laboratory schedules due to broken equipment/tools
   - c. accept the responsibility for self-management
5. ***Integrity/Honesty:*** *Chooses ethical courses of action*
   - a. accept the responsibility for own actions
   - b. exhibit personal honesty at all times
   - c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
   - d. understand the consequences of unethical behaviors

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

## COURSE SYLLABUS
# INDUSTRIAL MECHANICS I

# MAST PROGRAM
## COURSE SYLLABUS
## INDUSTRIAL MECHANICS I

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**Lecture hours/week: 5** **Lab hours/week: 5** **Credit hours: 7**

### COURSE DESCRIPTION:

Provides instruction in basic physics concepts applicable to mechanics of industrial production equipment, teaches basic industrial application of mechanical principles with emphasis placed on power transmission and specific mechanical components. Topics include: mechanical tools, fasteners, basic mechanics, lubrication, bearings, and packings and seals.

**PREREQUISITE: NONE**

### REQUIRED COURSE MATERIALS:

**Textbook:** Millwrights & Mechanics Guide
**Lab Manual:** Millwrights & Mechanics Guide

**Hand Tools/Quantity Required:**

| | |
|---|---|
| Safety Glasses | 1 pair |
| Classroom Supplies | 1 |
| Calculator | 1 |

### METHOD OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Drawings, Sketching, Machinery Instructions, Power Transmission | | 5 |
| V-Belt Drives, Flat Belts | | 5 |
| Chains, Couplings, Bearings | | 5 |
| Packing and Seals | | 5 |
| Mechanical Fasteners | | 5 |
| Wood Fasteners | | 5 |
| Gears | | 5 |
| Screw Threads | | 5 |
| Lubrication | Handouts | 5 |
| | **Total Lecture Hours** | **50** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Sketch Pillow Block, Label Drawing | 5 |
| Connect V-Belt Drive, Connect Flat Belt Drive | 5 |
| Demonstrate Chain Replacement | 5 |
| Demonstrate Removal and Installation of Mechanical Seals | 5 |
| Demonstrate Tightening Threaded Fasteners | 5 |
| Demonstrate Proper Installation of Nails, Wood Screws and Lag Screws | 5 |
| Demonstrate Installation of Spur, Helical and Worm Gears | 5 |
| Demonstrate Thread Tapping (English and Metric) | 5 |
| Demonstrate Lubrication Using Grease and Oil | 5 |
| Complete all Labs, Review | 5 |
| **Total Lab Hours** | **50** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

**A. PERFORM MEASUREMENT/INSPECTION**

1. Identify Types of Measurement Used in the Machine Shop
    - a. Distinguish between direct and calculated measurements
    - b. Compute calculated measurements
    - c. Justify the use of precision measurements in manufacturing
    - d. Discuss the following: precision, reliability , and accuracy
    - e. Demonstrate general measurement techniques
    - f. Demonstrate semi-precision measurement techniques
    - g. Demonstrate precision measurement techniques
    - h. Document results of measurement activities and calculations
2. Select Proper Measurement Tools
    - a. Match appropriate measurement tools with various types of measurement requirements

    - b. Demonstrate proper measurement tool usage
    - c. List steps of proper measurement
    - d. Explain rationale for each step
    - e. Identify error possibilities in measurement tool selection
    - f. Identify error possibilities within measurement procedures
    - g. Identify common conversion error possibilities
    - h. Discriminate between accepted measurement procedures and improper measurement procedures
- 3. Apply Proper Measuring Techniques
    - a. Explain calibration requirements of various precision instruments
    - b. Illustrate measurement differences when taken with calibrated and non-calibrated instruments
    - c. Justify use of particular measurement tools based on tool characteristics
    - d. Discuss factors affecting accurate measurement (i.e., dirt, temperature, etc.)
- 4. Use Metric and English Standards of Measurement
    - a. Discuss the English system of measurement
    - b. Discuss the Metric system of measurement
- 5. Perform Measurements With Hand Held Instruments
    - a. Measure with steel rules (metric and inch)
    - b. Measure with micrometers
    - c. Measure with comparison measuring instruments (i.e., calipers, telescope gages)
    - d. Measure with direct measuring instruments (i.e., vernier, dial, and digital instruments)
    - e. Measure with fixed gages (go and not go gages)
- 6. Perform Measurements on Surface Plate
    - a. Describe care of surface plate
    - b. Use surface plate accessories correctly (sine bar, gage blocks, etc.)
    - c. Check for part squareness
    - d. Check part dimensions for accuracy
    - e. Align workpieces using height gage and dial indicators

**B. REPAIR POWER TRANSMISSION SYSTEMS**

- 1. Belt Drives
    - a. Characteristics of pulley, sheaves, and belts
    - b. Safety precautions associated with inspecting pulleys, sheaves, and belts
    - c. Inspection criteria for pulleys/sheaves and belts
    - d. Adjustment of pulleys/sheaves and belts
    - e. Remove, inspect and install pulleys, belts and sheaves
    - f. Determine direction of rotation of the output shaft
- 2. Gear Drives
    - a. List inspection criteria for a gear assembly
    - b. Remove, clean, inspect and install a gear assembly
- 3. Chain Drives
    - a. List inspection criteria for a gear assembly
    - b. Remove, clean, inspect and install a chain drive assembly
    - c. Set tension on a chain drive assembly

C. **BEARING MAINTENANCE**
   1. Remove and Install a Journal Bearing
   2. Remove and Install an Anti-friction (Roller) Bearings
   3. Install and Remove a Thrust Bearing
   4. Identify Typical Cause of Bearing Failure
   5. Gather Vibration Analysis Data
      a. Determine sources of vibration
      b. Determine vibration specifications
      c. Determine vibration test points
      d. Obtain vibration readings using vibration analysis equipment

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

---

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
   *A. Resources: Identifies, organizes, plans, and allocates resources*
      1. follows a schedule to complete assigned tasks on time
      2. determine the initial cost of materials and "value added" as result of work
      3. complete a stock request form for required material
      4. provide a self-evaluation of performance based on the time and quality of work
   *B. Interpersonal: Works with others*
      1. complete assigned responsibilities within the shop floor serving as a member of the team
      2. provide individual assistance/direction to peers as requested
      3. perform work to acceptable levels of quality as required
      4. works well with all members of the class
   *C Information: Acquires and uses information*
      1. read and interpret blueprints
      2. organize and apply theories of machine tool operation
      3. perform basic semi-precision and precision layout as necessary
   *D. Systems: Understands complex inter-relationships*
      1. demonstrate knowledge of the following systems
         a. laboratory organization structure: physical and social
         b. organization of personnel and facilities on the shop floor
         c. systematic approach to the mechanical process

        - d. dimensioning and measurement systems
        - e. systematic organization of training materials
    - 2. monitors and corrects performance during
        - a. the practical process
        - b. adjustments of individual laboratory work schedule
        - c. constantly evaluating the quality of work to achieve acceptable standards
        - d. maintains record of evaluations and sets individual goals
- *E. Technology: Works with a variety of technologies*
    - 1. chooses procedure, tools and equipment required to perform the task
    - 2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
    - 3. maintains and troubleshoots equipment
        - a. applies appropriate preventative maintenance
        - b. when operating machines
        - c. reports all malfunctions of equipment to supervisor/instructor
        - d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

- *A. Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    - *1. Reading: Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
        - a. studies student laboratory manual
        - b. interprets blueprints and technical drawings
        - c. read/studies textbook
        - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
    - *2. Writing: Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
        - a. outline the steps necessary to perform a mechanical task
        - b. maintain a lecture notebook
        - c. submit written responses to chapter question assignments
        - d. complete all written assignments
    - *3. Arithmetic/Mathematics: Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        - a. keeps a running computation of individual grade
        - b. performs mathematical computations necessary to understand course
    - *4. Listening: Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. assimilate classroom instruction
        - b. interpret and assimilate video instruction
        - c. observe laboratory demonstrations

        d. seek and receive individualized instruction in the laboratory
    5. ***Speaking**: Organizes ideas and communicates orally*
        a. participates in classroom discussions
        b. organize ideas and communicate specific questions to the instructor
        c. verbally affirms understanding of a concept, procedure, or required skill
        d. communicates with peers to ensure the smooth and safe operation of the laboratory

B. ***Thinking Skills:** Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    1. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        a. identifies personal goals
        b. identifies actions required to accomplish personal goals
    2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
        a. makes daily accommodations to stay on schedule
        b. seeks additional instruction/clarification for assignment completion
        c. balances social and academic life/responsibilities
        d. accepts responsibility
    3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
        a. interprets technical drawings
        b. interprets technical illustrations and symbols
        c. understands both written and verbal instructions
        d. assimilates process during instructor demonstrations
    4. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
        a. demonstrate mastery of the basic skills and techniques
        b. use these sequential skills to support mastery of new skills
        c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
    5. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
        a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
        b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
        c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
    1. ***Responsibility:** Exerts a high level of effort and perseveres towards goal attainment*
        a. develops an understanding that in order to be successful you must be a "good" student

   - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
   - c. develops an understanding good students know what they are going to do in class and does not waste time
   - d. develops a fine work-ethic

2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
   - a. learns to take pride in his or her work through positive reinforcement
   - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   - a. assist classmates in improving technical skills
   - b. assist students with special needs as a peer mentor
   - c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   - a. maintain a record of academic achievement (individual grade book)
   - b. make accommodations to laboratory schedules due to broken equipment/tools
   - c. accept the responsibility for self-management
5. ***Integrity/Honesty:** Chooses ethical courses of action*
   - a. accept the responsibility for own actions
   - b. exhibit personal honesty at all times
   - c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
   - d. understand the consequences of unethical behaviors

**Machine Tool Advanced Skills**
**Technology Program**

# MAST

## COURSE SYLLABUS
# INTRODUCTION TO MICROCOMPUTERS

# MAST PROGRAM
## COURSE SYLLABUS
## INTRODUCTION TO MICROCOMPUTERS

**Lecture hours/week: 1** **Lab hours/week: 4** **Credit hours: 3**

**COURSE DESCRIPTION:**

Introduces fundamental concepts and operations necessary to utilize microcomputers. Emphasis is placed on basic functions and familiarity with computer use. Topics include: Computer terminology; operating systems; data storage; file management; equipment care and operation; and an introduction to word processing, database, and spreadsheet applications.

**PREREQUISITE: NONE**

**REQUIRED COURSE MATERIALS:**

| | |
|---|---|
| **Textbook:** | Learning to Use Microcomputer Applications (WordPerfect 5.1), Shelly, Cashman, Markowicz |
| **Lab Manual:** | Learning to Use Microcomputer Applications (WordPerfect 5.1), Shelly, Cashman, Markowicz |

**Materials/Quantity Required:**

| | |
|---|---|
| Classroom Supplies | 1 |
| Computer | 1 |

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Introduction to Computers | COM1 | 1 |
| TEST 1 | | |
| Working With Files on a Disk | DOS2 | 1 |
| Managing and Organizing Files on Disks | DOS25 | 1 |
| TEST 2 | | |
| Word Processing Using WordPerfect 5.1 | WP2 | 1 |
| The Keyboard | | |
| TEST 3 | | |
| Formatting Text | WP38 | 1 |
| TEST 4 | | |
| Review | | |
| Intro to Internet | Handouts | 1 |
| Moving, Searching and Replacing Text | WP83 | 1 |
| TEST 5 | | |
| Formatting a Document | WP112 | 1 |
| TEST 6 | | |
| Merging Documents | WP150 | 1 |
| TEST 7 | | |
| Review; FINAL EXAM | | 1 |
| | **Total Lecture Hours** | **10** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Student assignments; Hardware and Software | 4 |
| Student assignments; Format, Directory, and Rename Commands | 4 |
| Student assignments; Root Directory, MD and CD Commands | 4 |
| Creating and Editing a Document | 4 |
| Deleting and Blocking Text | 4 |
| Printing Multiple Pages and Spell Check | 4 |
| Identify, Text, Safe a Document | 4 |
| Page Format Menu, Line Format Menu | 4 |
| Merging, Creating a Primary File, Creating a Secondary File | 4 |
| Complete All Labs | 4 |
| **Total Lab Hours** | **40** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. USE COMPUTERS
   1. Perform Basic Word Processing
   2. Perform Basic Spread Sheet Operations

B. **APPLY MATHEMATICAL CONCEPTS**
   1. Perform Basic Arithmetic Functions
      a. Add, subtract, multiply, divide whole numbers
      b. Add, subtract, multiply, divide fractions
      c. Add, subtract, multiply, divide decimal numbers
   2. Convert Fractions /Decimals
   3. Convert English to Metric Measurement
      a. Use English to Metric conversion chart
      b. Perform calculations to convert English to Metric measurement
   4. Perform Basic Algebraic Operations
   5. Perform Basic Trigonometric Functions
   6. Perform Basic Geometric Calculations
      a. Calculate area

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

---

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
   *A.* ***Resources:** Identifies, organizes, plans, and allocates resources*
      1. follows a schedule to complete assigned tasks on time
      2. determine the initial cost of materials and "value added" as result of work
      3. complete a stock request form for required material
      4. provide a self-evaluation of performance based on the time and quality of work
   *B.* ***Interpersonal:** Works with others*
      1. complete assigned responsibilities within the shop floor serving as a member of the team
      2. provide individual assistance/direction to peers as requested
      3. perform work to acceptable levels of quality as required
      4. works well with all members of the class
   *C.* ***Information:** Acquires and uses information*
      1. read and interpret blueprints
      2. organize and apply theories of machine tool operation
      3. perform basic semi-precision and precision layout as necessary
   *D.* ***Systems:** Understands complex inter-relationships*
      1. demonstrate knowledge of the following systems
         a. laboratory organization structure: physical and social

        b. organization of personnel and facilities on the shop floor
        c. systematic approach to the mechanical process
        d. dimensioning and measurement systems
        e. systematic organization of training materials
    2. monitors and corrects performance during
        a. the practical process
        b. adjustments of individual laboratory work schedule
        c. constantly evaluating the quality of work to achieve acceptable standards
        d. maintains record of evaluations and sets individual goals

*E.* ***Technology:*** *Works with a variety of technologies*
    1. chooses procedure, tools and equipment required to perform the task
    2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
    3. maintains and troubleshoots equipment
        a. applies appropriate preventative maintenance
        b. when operating machines
        c. reports all malfunctions of equipment to supervisor/instructor
        d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

*A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
        a. studies student laboratory manual
        b. interprets blueprints and technical drawings
        c. read/studies textbook
        d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
    *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
        a. outline the steps necessary to perform a mechanical task
        b. maintain a lecture notebook
        c. submit written responses to chapter question assignments
            d. complete all written assignments
    *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        a. keeps a running computation of individual grade
        b. performs mathematical computations necessary to understand course
    *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
        a. assimilate classroom instruction
        b. interpret and assimilate video instruction

c. observe laboratory demonstrations
d. seek and receive individualized instruction in the laboratory

*5.* ***Speaking:*** *Organizes ideas and communicates orally*

a. participates in classroom discussions
b. organize ideas and communicate specific questions to the instructor
c. verbally affirms understanding of a concept, procedure, or required skill
d. communicates with peers to ensure the smooth and safe operation of the laboratory

*B.* ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

*1.* ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*

a. identifies personal goals
b. identifies actions required to accomplish personal goals

*2.* ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*

a. makes daily accommodations to stay on schedule
b. seeks additional instruction/clarification for assignment completion
c. balances social and academic life/responsibilities
d. accepts responsibility

*3.* ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*

a. interprets technical drawings
b. interprets technical illustrations and symbols
c. understands both written and verbal instructions
d. assimilates process during instructor demonstrations

*4.* ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*

a. demonstrate mastery of the basic skills and techniques
b. use these sequential skills to support mastery of new skills
c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques

*5.* ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*

a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly.

*C.* ***Personal Qualities:*** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.

*1.* ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*

a. develops an understanding that in order to be successful you must be a "good" student

b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work

c. develops an understanding good students know what they are going to do in class and does not waste time

d. develops a fine work-ethic

2. *Self-Esteem: Believes in own self-worth and maintains a positive view of self*

   a. learns to take pride in his or her work through positive reinforcement
   b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*

   a. assist classmates in improving technical skills
   b. assist students with special needs as a peer mentor
   c. share laboratory resources (machines, tools and instructor's individual attention)

4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*

   a. maintain a record of academic achievement (individual grade book)
   b. make accommodations to laboratory schedules due to broken equipment/tools
   c. accept the responsibility for self-management

5. *Integrity/Honesty: Chooses ethical courses of action*

   a. accept the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
   d. understand the consequences of unethical behaviors

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*T*echnology Program

# MAST

# COURSE SYLLABUS
# ENGLISH

# MAST PROGRAM
## COURSE SYLLABUS
## ENGLISH

**Lecture hours/week: 5** **Lab hours/week: 0** **Credit hours: 5**

**COURSE DESCRIPTION:**

Emphasizes the development and improvement of written and oral communication abilities. Topics include: analysis of writing techniques used in selected readings, writing practice, editing and proofreading, research skills, and oral presentation skills. Homework assignments reinforce classroom learning.

**PREREQUISITE/COREQUISITE:** **English III and Reading III, or the equivalent.**

**REQUIRED COURSE MATERIALS:**

**Textbook:** English Skills, Langan, J. (Fifth Ed., 1993), New York: McGraw-Hill

**Materials:**
Loose leaf paper
Loose leaf binder
Blue or black pen
Pencil
Highlighter

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture and discussions.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. satisfactorily perform on written, oral, and practical examinations
2. satisfactorily perform on outside assignments including writing assignments
3. contribute to class discussions
4. maintain attendance per current policy

**LECTURE OUTLINE:**

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| **Grammar Pretest and Paragraph**<br>Introduction to the Course<br>The Computer Grammar Project<br>One-minute Introductory Speech:<br>"Who Am I?" | **Pages 7-10** | 5 |

|  |  |  |
|---|---|---|
| **Introduction to the Paragraph** | **Pages 3-6** | 5 |
| The Evaluation of a Paragraph | Page 92 |  |
| "The Paper Format" | Pages 431-435 |  |
| Introduction to the Portfolio or Journal Notebook |  |  |
| (Entries will be evaluated throughout the quarter at the instructor's discretion) |  |  |
| Example Paragraph | Pages 127-134 |  |
| Spelling Test #1 (Words 1-50) | Handout |  |
| **"Important Factors in Writing"** | **Pages 11-42** | 5 |
| Narrative Paragraph | Pages 191-198 |  |
| Grammar and Mechanics Skills as Needed |  |  |
| Spelling Test #2 (Words 50-100) | Handout |  |
| **Library Orientation and Library Project** | **Pages 291-307** | 5 |
| The Abstract | Pages 274-276 |  |
| Grammar and Mechanics Skills as Needed |  |  |
| Spelling Test #3 (Words 100-150) | Handout |  |
| **"Speaking One to One Thousand"** |  | 5 |
| Listening Skills |  |  |
| Oral Presentation #2 |  |  |
| Grammar and Mechanics Skills as Needed |  |  |
| Spelling Test #4 (Words 150-200) | Handout |  |
| **"The First and Second Steps in Writing"** | **Pages 43-71** | 5 |
| "The Third and Fourth Steps in Writing" | Pages 72-90 |  |
| Description Paragraph | Pages 181-190 |  |
| Dividing and Classifying Paragraph | Pages 172-180 |  |
| OR |  |  |
| Comparing and Contrasting Paragraph | Pages 152-164 |  |
| Turn in Portfolio or Journal Notebook for final evaluation |  |  |
| Spelling Test #5 (Words 200-250) | Handout |  |
| **Oral Presentation #3: The Process Speech** |  | 5 |
| with the help of a visual aid | Pages 135-142 |  |
| Grammar and Mechanics Skills as Needed |  |  |
| Spelling Test #6 (Words 250-300) | Handout |  |
| **Business Items: The Resume, Cover Letter, and Memo** | **Pages 285-290** | 5 |
| Cause and Effect Paragraph | Pages 143-151 |  |
| Grammar and Mechanics Skills as Needed |  |  |
| Spelling Test #7 (Words 300-350) | Handout |  |
| **"Four Bases for Evaluating Writing"** | **Pages 92-117** | 5 |
| Computer Grammar project due |  |  |
| Grammar Post-Test |  |  |

| | | |
|---|---|---|
| Spelling Test #8 (Words 350-400) | Handout | |
| **Review Week** | | 5 |
| Spelling Test #9 (Words 400-450) | Handout | — |
| | **Total Lecture Hours** | **50** |

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in it's "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

**I. COMPETENCIES**

A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
   1. follows a schedule to complete assigned tasks on time
   2. determine the initial cost of materials and "value added" as result of work
   3. domplete a stock request form for required material
   4. provide a self-evaluation of performance based on the time and quality of work

B. ***Interpersonal:*** *Works with others*
   1. complete assigned responsibilities within the shop floor serving as a member of the team
   2. provide individual assistance/direction to peers as requested
   3. perform work to acceptable levels of quality as required
   4. works well with all members of the class

C. ***Information:*** *Acquires and uses information*
   1. read and interpret blueprints
   2. organize and apply theories of machine tool operation
   3. perform basic semi-precision and precision layout as necessary

D. ***Systems:*** *Understands complex inter-relationships*
   1. demonstrate knowledge of the following systems
      a. laboratory organization structure: physical and social
      b. organization of personnel and facilities on the shop floor
      c. systematic approach to the mechanical process
      d. dimensioning and measurement systems
      e. systematic organization of training materials
   2. monitors and corrects performance during
      a. the practical process
      b. adjustments of individual laboratory work schedule

- c. constantly evaluating the quality of work to achieve acceptable standards
- d. maintains record of evaluations and sets individual goals

*E.* ***Technology:** Works with a variety of technologies*

1. chooses procedure, tools and equipment required to perform the task
2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
3. maintains and troubleshoots equipment
    - a. applies appropriate preventative maintenance
    - b. when operating machines
    - c. reports all malfunctions of equipment to supervisor/instructor
    - d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

*A.* ***Basic Skills:** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

*1.* ***Reading:** Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*

- a. studies student laboratory manual
- b. interprets blueprints and technical drawings
- c. read/studies textbook
- d. follow a daily laboratory schedule to maintain appropriate time-line and task completion

*2.* ***Writing:** Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*

- a. outline the steps necessary to perform a mechanical task
- b. maintain a lecture notebook
- c. submit written responses to chapter question assignments
- d. complete all written assignments

*3.* ***Arithmetic/Mathematics:** Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*

- a. keeps a running computation of individual grade
- b. performs mathematical computations necessary to understand course

*4.* ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*

- a. assimilate classroom instruction
- b. interpret and assimilate video instruction
- c. observe laboratory demonstrations
- d. seek and receive individualized instruction in the laboratory

*5.* ***Speaking**: Organizes ideas and communicates orally*

- a. participates in classroom discussions
- b. organize ideas and communicate specific questions to the instructor

        - c. verbally affirms understanding of a concept, procedure, or required skill
        - d. communicates with peers to ensure the smooth and safe operation of the laboratory

- *B.* ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    - *1.* ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        - a. identifies personal goals
        - b. identifies actions required to accomplish personal goals
    - *2.* ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
        - a. makes daily accommodations to stay on schedule
        - b. seeks additional instruction/clarification for assignment completion
        - c. balances social and academic life/responsibilities
        - d. accepts responsibility
    - *3.* ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
        - a. interprets technical drawings
        - b. interprets technical illustrations and symbols
        - c. understands both written and verbal instructions
        - d. assimilates process during instructor demonstrations
    - *4.* ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
        - a. demonstrate mastery of the basic skills and techniques
        - b. use these sequential skills to support mastery of new skills
        - c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
    - *5.* ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
        - a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
        - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
        - c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly.
- *C.* ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
    - *1.* ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
        - a. develops an understanding that in order to be successful you must be a "good" student
        - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
        - c. develops an understanding good students know what they are going to do in class and does not waste time

    d. develops a fine work-ethic

2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. maintain a record of academic achievement (individual grade book)
    b. make accommodations to laboratory schedules due to broken equipment/tools
    c. accept the responsibility for self-management
5. ***Integrity/Honesty:** Chooses ethical courses of action*
    a. accept the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
    d. understand the consequences of unethical behaviors

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*T*echnology Program

# MAST

## COURSE SYLLABUS

# ALTERNATING CURRENT I

# MAST PROGRAM
## COURSE SYLLABUS
## ALTERNATING CURRENT I

**Lecture hours/week: 3** **Lab hours/week: 2** **Credit hours: 4**

**COURSE DESCRIPTION:**

Introduces the theory and application of varying sine wave voltages and current. Topics include: A.C. wave generation factors such as peak, peak to peak, average, and RMS values; frequency and phase relationships in R, RL, RC, and RLC circuits; and impedance admittance, and conductance power factors calculated from given and/or measured values.

**PREREQUISITE: Direct Current Circuits**

**REQUIRED COURSE MATERIALS:**

| | |
|---|---|
| **Textbook:** | Electricity 2, Kubala, Delmar Publishing |
| **Lab Manual:** | Lab Manuals are issued as a text and must be returned before Final Exam is taken. |

**Hand Tools/Quantity Required:**
Safety Glasses
Classroom Supplies
Calculator
Volt-Ohm Meter w/Test Leads

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Alternating Current | 94 | 3 |
| Wheatstone Bridge | 56 | 3 |
| Electronic Charges | 76 | 3 |
| Filmstrip 802-6, "Magnetism and Electro-Magnetism", Bergwall | | |
| Capacitors | 82 | 3 |
| Inductors | Handout | 3 |
| Oscilloscope | 88 | 3 |
| Inductive Circuits | 100 | 3 |
| Capacitive Circuits | Handout | 3 |
| Reactive Circuits | 106 | 3 |
| Filmstrip 802-7, "Inductors and Inductive Reactance", Bergwall | | |
| Filmstrip #802-9, "Capacitors and Capacitive Reactive", Bergwall | | |
| Final Exam | | 3 |
| | Total Lecture Hours | 30 |

## LAB OUTLINE:

| Lab Topic | Contact Hrs. |
|---|---|
| Work Problems with Alternating Current | 2 |
| Construct Wheatstone Bridge | 2 |
| Work Problems - Electrostatic Charges | 2 |
| Build Capacitor Circuit | 2 |
| Build Inductor Circuit | 2 |
| Oscilloscope to Measure Voltage, Frequency | 2 |
| Work Problems - Inductive Circuits - Measure Voltage | 2 |
| Work Problems - Capacitive Circuits - Measure Voltage | 2 |
| Work Problems - Reactive Circuits - Measure Current | 2 |
| Complete all Labs | 2 |
| Total Lab Hours | 20 |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. PRACTICE SAFETY
  1. Recognize OSHA Requirements
  2. Demonstrate Use of Personal Protective Equipment

B. APPLY MATHEMATICAL CONCEPTS
  1. Perform Basic Arithmetic Functions
    a. Add, subtract, multiply, divide whole numbers
    b. Add, subtract, multiply, divide fractions

        - c. Add, subtract, multiply, divide decimal numbers
    - 2. Convert Fractions /Decimals
    - 3. Convert English to Metric Measurement
        - a. Use English to Metric conversion chart
        - b. Perform calculations to convert English to Metric measurement
    - 4. Perform Basic Algebraic Operations
    - 5. Perform Basic Trigonometric Functions

**C. INTERPRET ENGINEERING DRAWINGS**

- 1. Identify the Purpose of Listed Notes and Dimensions
    - a. Interpret the notes on a blueprint or mechanical drawing
    - b. Identify scale on a blueprint or mechanical drawing
    - c. Identify methods of dimensioning objects
        - 1) Cylinders
        - 2) Arcs
        - 3) Holes
        - 4) Counter bored Holes
        - 5) Countersink Holes
        - 6) Angles
        - 7) Circle Centers
    - d. Define tolerance as used in interpretation of mechanical drawings
    - e. Identify document identification code.
    - f. Drawing abbreviations and acronyms
    - g. Interpret symbols used to illustrate surface finishes on a blueprint
- 2. Identify Basic Layout of Drawings
    - a. Alphabet of lines
    - b Types of lines used on blueprints and mechanical drawings
    - c. Identify drawings views
- 3. Make a Drawing Using Each of the Basic Types of Drawings Listed
    - a. Simple isometric sketch
    - b. Single line symbols for pipe and fittings
    - c. Piping and Instrumentation Diagram (P&ID)
    - d. Orthographic drawing

**D. USE TOOLS**

- 1. Identify and Use Shop Hand Tools
    - a. Use and care of wrenches
    - b. Use and care of screwdrivers
    - c. Use and care of pliers and cutters
    - d. Use and care of striking tools
    - e. Use and care of bearing pullers
    - f. Use and care of threading and reaming equipment
    - g. Use and care of files
- 2. Identify and Use Hand Held Power Tools

**E. MAINTAIN ELECTRICAL DEVICES**

- 1. Use Electrical Test Equipment
- 2. Apply Specific Terms to Electrical Circuits
- 3. Analyze Series , Parallel and Complex Circuits
- 4. Check AC & DC Motors for Proper Operation
- 5. Troubleshoot Electrical Devices

## COURSE OBJECTIVES: SCANS COMPETENCIES

The *Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

### I. COMPETENCIES

- *A. Resources: Identifies, organizes, plans, and allocates resources*
  - 1. follows a schedule to complete assigned tasks on time
  - 2. determine the initial cost of materials and "value added" as result of work
  - 3. complete a stock request form for required material
  - 4. provide a self-evaluation of performance based on the time and quality of work
- *B. Interpersonal: Works with others*
  - 1. complete assigned responsibilities within the shop floor serving as a member of the team
  - 2. provide individual assistance/direction to peers as requested
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- C. *Information: Acquires and uses information*
  - 1. read and interpret blueprints
  - 2. organize and apply theories of machine tool operation
  - 3. perform basic semi-precision and precision layout as necessary
- *D. Systems: Understands complex inter-relationships*
  - 1. Demonstrate knowledge of the following systems
    - a. laboratory organization structure: physical and social
    - b. organization of personnel and facilities on the shop floor
    - c. systematic approach to the mechanical process
    - d. dimensioning and measurement systems
    - e. systematic organization of training materials
  - 2. Monitors and corrects performance during
    - a. the practical process
    - b. adjustments of individual laboratory work schedule
    - c. constantly evaluating the quality of work to achieve acceptable standards
    - d. maintains record of evaluations and sets individual goals
- *E. Technology: Works with a variety of technologies*
  - 1. Chooses procedure, tools and equipment required to perform the task
  - 2. Applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards

3. Maintains and troubleshoots equipment
    a. applies appropriate preventative maintenance
    b. when operating machines
    c. reports all malfunctions of equipment to supervisor/instructor
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    - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
- *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
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    - b. maintain a lecture notebook
    - c. submit written responses to chapter question assignments
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- *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
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- *1.* ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    - a. identifies personal goals

b. identifies actions required to accomplish personal goals

2. *Problem Solving: Recognizes problems and devises and implements plan of action*
   a. makes daily accommodations to stay on schedule
   b. seeks additional instruction/clarification for assignment completion
   c. balances social and academic life/responsibilities
   d. accepts responsibility
3. *Seeing Things In the Mind's Eye: Organizes, and processes symbols, pictures, graphs, objects, and other information*
   a. interprets technical drawings
   b. interprets technical illustrations and symbols
   c. understands both written and verbal instructions
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   a. demonstrate mastery of the basic skills and techniques
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   b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
   c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly.

C. *Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. *Responsibility: Exerts a high level of effort and perseveres towards goal attainment*
   a. develops an understanding that in order to be successful you must be a "good" student
   b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
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   d. develops a fine work-ethic
2. *Self-Esteem: Believes in own self-worth and maintains a positive view of self*
   a. learns to take pride in his or her work through positive reinforcement
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   c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
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    c. share laboratory resources (machines, tools and instructor's individual attention)
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. maintain a record of academic achievement (individual grade book)
    b. make accommodations to laboratory schedules due to broken equipment/tools
    c. accept the responsibility for self-management
5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accept the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
    d. understand the consequences of unethical behaviors

ELC 109
02/081196

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**MAST**

# COURSE SYLLABUS
# ALTERNATING CURRENT II

# MAST PROGRAM
## COURSE SYLLABUS
## ALTERNATING CURRENT II

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**Lecture hours/week: 3** **Lab hours/week: 2** **Credit hours: 4**

### COURSE DESCRIPTION:

Introduces the theory and application of varying sine wave voltages and current. Topics include: A.C. wave generation factors such as peak, peak to peak, average, and RMS values; frequency and phase relationships in R, RL, RC, and RLC circuits; and impedance admittance, and conductance power factors calculated from given and/or measured values.

**PREREQUISITE:** **Alternating Current I**

### REQUIRED COURSE MATERIALS:

**Textbook:** Electricity 2, Kubala, Delmar Publishing.
**Lab Manual:** Lab Manuals are issued as a text and must be returned before Final Exam is taken.

**Hand Tools/Quantity Required:**
Tools
Safety Glasses
Classroom Supplies
Calculator
Volt-Ohm Meter w/test leads

### METHOD OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| AC Power - Single Phase | 126 | 3 |
| Resonance - Series and Parallel | 132 | 3 |
| AC Power - Three Phase | Textbook 2 - 111 | 3 |
| Impedance Matching | 148 | 3 |
| Transformer - Single Phase | Textbook 2 - 135 | 3 |
| Filmstrip #802d-8, "Transformer", Bergwall | | |
| Transformer - Three Phase | Textbook 2 - 135 | 3 |
| Motors - Single Phase | Textbook 2 - 209 | 3 |
| Motors - Three Phase | Textbook 2 - 77 | 3 |
| Generators - Three Phase | Textbook 2 - 31 | 3 |
| Final Exam | | 3 |
| | **Total Lecture Hours** | **30** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Connect Single Phase Power Circuit and Measure Power | 2 |
| Connect Series and Parallel Resonance Circuits and Measure Impedance | 2 |
| Connect Three Phase Circuits - Measure Voltages | 2 |
| Connect Impedance Matching Circuit and Measure Impedance | 2 |
| Connect Transformer - Measure Voltage | 2 |
| Connect Delta and Wye Three Phase Transformers | 2 |
| Wire Single Phase Motors, Start and Run, Measure Torque | 2 |
| Wire Three Phase Motors, Start and Run | 2 |
| Wire Three Phase Generator to Supply Three Phase Load | 2 |
| Complete All Labs | 2 |
| **Total Lab Hours** | **20** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
  1. Recognize OSHA Requirements
  2. Demonstrate Use of Personal Protective Equipment

B. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Functions
     a. Add, subtract, multiply, divide whole numbers
     b. Add, subtract, multiply, divide fractions
     c. Add, subtract, multiply, divide decimal numbers
  2. Convert Fractions/Decimals
  3. Convert English to Metric Measurement
     a. Use English to Metric conversion chart
     b. Perform calculations to convert English to Metric measurement
  4. Perform Basic Algebraic Operations

5. Perform Basic Trigonometric Functions
6. Perform Basic Geometric Calculations
    a. Calculate area, per

C. **INTERPRET ENGINEERING DRAWINGS**
1. Identify the Purpose of Listed Notes and Dimensions
    a. Interpret the notes on a blueprint or mechanical drawing
    b. Identify scale on a blueprint or mechanical drawing
    c. Identify methods of dimensioning objects
        1) Cylinders
        2) Arcs
        3) Holes
        4) Counter bored Holes
        5) Countersink Holes
        6) Angles
        7) Circle Centers
    d. Define tolerance as used in interpretation of mechanical drawings
    e. Identify document identification code.
    f. Drawing abbreviations and acronyms
    g. Interpret symbols used to illustrate surface finishes on a blueprint
2. Identify Basic Layout of Drawings
    a. Alphabet of lines
    b Types of lines used on blueprints and mechanical drawings
    c. Identify drawings views
3. Make a Drawing Using Each of the Basic Types of Drawings Listed
    a. Simple isometric sketch
    b. Single line symbols for pipe and fittings
    c. Piping and Instrumentation Diagram (P&ID)
    d. Orthographic drawing

D. **USE TOOLS**
1. Identify and Use Shop Hand Tools
    a. Use and care of wrenches
    b. Use and care of screwdrivers
    c. Use and care of pliers and cutters
    d. Use and care of striking tools
    e. Use and care of bearing pullers
    f. Use and care of threading and reaming equipment
    g. Use and care of files
2. Identify and Use Hand Held Power Tools
    a. Use and care portable grinders
    b. Use and care of portable drill motors
    c. Use and care of portable band saws
    d. Use and care of portable reciprocating saws

E. **MAINTAIN ELECTRICAL DEVICES**
1. Use Electrical Test Equipment
2. Apply Specific Terms to Electrical Circuits
3. Analyze Series , Parallel and Complex Circuits
4. Check AC& DC Motors for Proper Operation
5. Troubleshoot Electrical Devices

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in it's "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**
  - A. ***Resources:** Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. determine the initial cost of materials and "value added" as result of work
    3. complete a stock request form for required material
    4. provide a self-evaluation of performance based on the time and quality of work
  - B. ***Interpersonal:** Works with others*
    1. complete assigned responsibilities within the shop floor serving as a member of the team
    2. provide individual assistance/direction to peers as requested
    3. perform work to acceptable levels of quality as required
    4. works well with all members of the class
  - C. ***Information:** Acquires and uses information*
    1. read and interpret blueprints
    2. organize and apply theories of machine tool operation
    3. perform basic semi-precision and precision layout as necessary
  - D. ***Systems:** Understands complex inter-relationships*
    1. demonstrate knowledge of the following systems
       - a. laboratory organization structure: physical and social
       - b. organization of personnel and facilities on the shop floor
       - c. systematic approach to the mechanical process
       - d. dimensioning and measurement systems
       - e. systematic organization of training materials
    2. monitors and corrects performance during
       - a. the practical process
       - b. adjustments of individual laboratory work schedule
       - c. constantly evaluating the quality of work to achieve acceptable standards
       - d. maintains record of evaluations and sets individual goals
  - E. ***Technology:** Works with a variety of technologies*
    1. chooses procedure, tools and equipment required to perform the task
    2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards

3. maintains and troubleshoots equipment
    a. applies appropriate preventative maintenance
    b. when operating machines
    c. reports all malfunctions of equipment to supervisor/instructor
    d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

A. ***Basic Skills:*** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.

1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    a. studies student laboratory manual
    b. interprets blueprints and technical drawings
    c. read/studies textbook
    d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    a. outline the steps necessary to perform a mechanical task
    b. maintain a lecture notebook
    c. submit written responses to chapter question assignments
    d. complete all written assignments
3. ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    a. keeps a running computation of individual grade
    b. performs mathematical computations necessary to understand course
4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    a. assimilate classroom instruction
    b. interpret and assimilate video instruction
    c. observe laboratory demonstrations
    d. seek and receive individualized instruction in the laboratory
5. ***Speaking:*** *Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor
    c. verbally affirms understanding of a concept, procedure, or required skill
    d. communicates with peers to ensure the smooth and safe operation of the laboratory

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    a. identifies personal goals

        - b. identifies actions required to accomplish personal goals
    - 2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
        - a. makes daily accommodations to stay on schedule
        - b. seeks additional instruction/clarification for assignment completion
        - c. balances social and academic life/responsibilities
        - d. accepts responsibility
    - 3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
        - a. interprets technical drawings
        - b. interprets technical illustrations and symbols
        - c. understands both written and verbal instructions
        - d. assimilates process during instructor demonstrations
    - 4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
        - a. demonstrate mastery of the basic skills and techniques
        - b. use these sequential skills to support mastery of new skills
        - c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
    - 5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
        - a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
        - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
        - c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly.
- *C.* ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
    - 1. ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
        - a. develops an understanding that in order to be successful you must be a "good" student
        - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
        - c. develops an understanding good students know what they are going to do in class and does not waste time
        - d. develops a fine work-ethic
    - 2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
        - a. learns to take pride in his or her work through positive reinforcement
        - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
        - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. share laboratory resources (machines, tools and instructor's individual attention)
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. maintain a record of academic achievement (individual grade book)
    b. make accommodations to laboratory schedules due to broken equipment/tools
    c. accept the responsibility for self-management
5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accept the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
    d. understand the consequences of unethical behaviors

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MAST

# COURSE SYLLABUS
# PUMPS & PIPING SYSTEMS

# MAST PROGRAM
## COURSE SYLLABUS
## PUMPS AND PIPING SYSTEMS

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**Lecture hours/week: 1** **Lab hours/week: 4** **Credit hours: 2**

**COURSE DESCRIPTION:**

Provides instruction in the fundamental concepts of industrial pumps and piping systems. Topics include: pump identification, pump operations, pump installation, maintenance, troubleshooting, piping systems and installation of piping systems.

**PREREQUISITES:** **Industrial Mechanics I**
**Industrial Pneumatics**

**REQUIRED COURSE MATERIALS:**

**Textbook 1:** Pumps, Schoolcraft Publishing
**Textbook 2:** Piping Systems, Schoolcraft Publishing
**Lab Manual:** Fluid Power, Parker. (Lab manuals are issued as a text and must be returned before Final Exam is taken.)

**Hand Tools/Quantity Required:**

| | |
|---|---|
| Safety Glasses | 1 pair |
| Classroom Supplies | 1 |
| Calculator | 1 |

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Gear Pumps | 11-7 | 1 |
| Vane Pumps | 11-1 | 1 |
| Rotary Piston Pumps | 11-11 | 1 |
| Reciprocating Piston Pumps | 11-11 | 1 |
| Bent Axis Piston Pump | 11-12 | 1 |
| Axial Piston Pump | 11-13 | 1 |
| Filters - Intake and Sump | 11-14 | 1 |
| Rigid Pipe | | 1 |
| Flexible Piping | | 1 |
| Plan Piping Installation | | 1 |
| | **Total Lecture Hours** | **10** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Rebuild Gear Pump | 4 |
| Rebuild Vane Pump | 4 |
| Rebuild Rotary Piston Pump | 4 |
| Rebuild Reciprocating Piston Pump | 4 |
| Rebuild Bent Axis Piston Pump | 4 |
| Rebuild Axial Piston Pump | 4 |
| Remove and Install Filters | 4 |
| Install Rigid Piping System | 4 |
| Install Flexible Piping System | 4 |
| Plan Piping Installation | 4 |
| **Total Lecture Hours** | **40** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
  1. Recognize OSHA Requirements
  2. Demonstrate Use of Personal Protective Equipment

B. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Functions
    a. Add, subtract, multiply, divide whole numbers
    b. Add, subtract, multiply, divide fractions
    c. Add, subtract, multiply, divide decimal numbers
  2. Convert Fractions/Decimals
  3. Convert English to Metric Measurement
    a. Use English to Metric conversion chart
    b. Perform calculations to convert English to Metric measurement

C. **USE TOOLS**
  1. Identify and Use Shop Hand Tools

  - a. Use and care of wrenches
  - b. Use and care of screwdrivers
  - c. Use and care of pliers and cutters
  - d. Use and care of striking tools
  - e. Use and care of bearing pullers
  - f. Use and care of threading and reaming equipment
  - g. Use and care of files
- 2. Identify and Use Hand Held Power Tools
  - a. Use and care portable grinders
  - b. Use and care of portable drill motors
  - c. Use and care of portable band saws
  - d. Use and care of portable reciprocating saws

### D. MAINTAIN/TROUBLESHOOT EQUIPMENT AND SYSTEMS

- 1. Maintain Air Conditioning System
  - a. Describe the refrigeration cycle
- 2. Maintain Pneumatic Control Circuit
  - a. Troubleshoot a pneumatic circuit
- 3. Maintain Centrifugal Pumps
  - a. Perform disassembly, inspection and assembly of couplings purpose of coupling types of rigid couplings types of mechanical flexible coupling types of material flexible coupling parts of a coupling
  - b. Remove, install and set seal assemblies Mechanical seals Packing assemblies
  - c. Perform disassembly, inspection, repair and assembly of centrifugal pumps
- 4. Maintain Positive Displacement Pumps
  - a. Identify types of positive displacement pumps
    - 1) Piston
    - 2) Gear
    - 3) Vane
    - 4) Screw
    - 5) Diaphragm
    - 6) Plunger
  - b. Perform disassembly, inspection, repair and assembly of positive displacement pumps
- 5. Maintain Gate, Globe, Ball and Plug Valves
  - a. Identify component parts
  - b. Perform dissemble, inspection, repair and assembly
- 6. Maintain Check Valves and Relief Valves
  - a. Identify component parts
  - b. Perform disassembly, inspection, repair and assembly of check valve
- 7. Maintain Fans & Blowers
  - a. Identify different types of fans and blowers
  - b. Describe typical maintenance required on fans and blowers
- 8. Maintain Hydraulics System
  - a. Identify ANSI hydraulic system drawing symbols
  - b. Perform disassembly inspection and reassemble of hydraulic system components

## COURSE OBJECTIVES: SCANS COMPETENCIES

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The following activities will be performed by each student for successful completion of this course:

### I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. determine the initial cost of materials and "value added" as result of work
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    4. provide a self-evaluation of performance based on the time and quality of work
- *B.* ***Interpersonal:*** *Works with others*
    1. complete assigned responsibilities within the shop floor serving as a member of the team
    2. provide individual assistance/direction to peers as requested
    3. perform work to acceptable levels of quality as required
    4. works well with all members of the class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and interpret blueprints
    2. organize and apply theories of machine tool operation
    3. perform basic semi-precision and precision layout as necessary
- *D.* ***Systems:*** *Understands complex inter-relationships*
    1. demonstrate knowledge of the following systems:
        - a. laboratory organization structure: physical and social
        - b. organization of personnel and facilities on the shop floor
        - c. systematic approach to the mechanical process
        - d. dimensioning and measurement systems
        - e. systematic organization of training materials
    2. monitors and corrects performance during
        - a. the practical process
        - b. adjustments of individual laboratory work schedule
        - c. constantly evaluating the quality of work to achieve acceptable standards
        - d. maintains record of evaluations and sets individual goals
- *E.* ***Technology:*** *Works with a variety of technologies*
    1. chooses procedure, tools and equipment required to perform the task
    2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
    3. maintains and troubleshoots equipment

a. applies appropriate preventative maintenance
b. when operating machines
c. reports all malfunctions of equipment to supervisor/instructor
d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

II. **FOUNDATION SKILLS**

A. ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
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    b. interprets blueprints and technical drawings
    c. read/studies textbook
    d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
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4. ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
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    - c. balances social and academic life/responsibilities
    - d. accepts responsibility
3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
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    - b. interprets technical illustrations and symbols
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4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
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    - b. use these sequential skills to support mastery of new skills
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5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    - a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
    - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
    - c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
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    - d. develops a fine work-ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*

a. assist classmates in improving technical skills
b. assist students with special needs as a peer mentor
c. share laboratory resources (machines, tools and instructor's individual attention)

4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   a. maintain a record of academic achievement (individual grade book)
   b. make accommodations to laboratory schedules due to broken equipment/tools
   c. accept the responsibility for self-management
5. ***Integrity/Honesty:** Chooses ethical courses of action*
   a. accept the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
   d. understand the consequences of unethical behaviors

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***T*echnology Program**

**MAST**

## COURSE SYLLABUS
# INDUSTRIAL HYDRAULICS

# MAST PROGRAM
## COURSE SYLLABUS
## INDUSTRIAL HYDRAULICS

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**Lecture hours/week:** 6 **Lab hours/week:** 4 **Credit hours:** 8

## COURSE DESCRIPTION:

Provides instruction in fundamental concepts and theories for the safe operation of hydraulic components and systems. Topics include: hydraulic theory, suction side of pumps, actuators, valves, pumps/motors, accumulators, symbols and circuitry, types of fluids, filters, servicing safety, preventative maintenance and troubleshooting.

**PREREQUISITE:** **NONE**

## REQUIRED COURSE MATERIALS:

**Textbook:** Industrial Hydraulics Manual
**Lab Manual:** Fluid Power, Parker; Lab Manuals are issued as a text and must be returned before Final Exam is taken.

**Hand Tools/Quantity Required:**

| | |
|---|---|
| Tools | |
| Safety Glasses | 1 pair |
| Classroom Supplies | 1 |
| Calculator | 1 |

## METHOD OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Contact Hrs. |
|---|---|
| **Hydraulic Theory** | 5 |
| Definition of Terms | |
| Principles | |
| Operational Conditions | |
| Computing Units of Measure | |
| Power Transmission | |
| **Suction Side of Pumps** | 7 |
| Cavitation | |
| Atmospheric Pressure | |
| **Actuators** | 6 |
| Inspection | |
| Alignment | |
| **Valves** | 16 |
| Inspection | |
| Pressure | |
| Flow Rate | |
| Null Procedure | |
| Replacement and Adjustment | |
| **Pumps/Motors** | 6 |
| **Inspection Accumulators** | 2 |
| Testing | |
| Replacement | |
| **Symbols and Circuitry** | 5 |
| Component Identification | |
| **Types of Fluids** | 5 |
| Composition of Fluids | |
| Types | |
| Selection of Oil | |
| **Filters** | 2 |
| Verification | |
| Cleaning and Replacement | |
| **Servicing Safety** | 2 |
| Protective Clothing | |
| Repair and Replacement | |
| **Preventive Maintenance** | 2 |
| Program Elements | |
| Program Selection | |
| Fluid Checks | |
| Replacement | |
| Alignment | |
| Lines | |
| **Troubleshooting** | 2 |
| Application | |
| **Total Lecture Hours** | **60** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Suction Side of Pumps | 2 |
| Actuators | 6 |
| Valves | 8 |
| Pumps/Motors | 5 |
| Inspection Accumulators | 4 |
| Filters | 5 |
| Preventive Maintenance | 5 |
| Troubleshooting | 5 |
| **Total Lab Hours** | **40** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Functions
    a. Add, subtract, multiply, divide whole numbers
    b. Add, subtract, multiply, divide fractions
    c. Add, subtract, multiply, divide decimal numbers
  2. Convert Fractions/Decimals
  3. Convert English to Metric Measurement
    a. Use English to Metric conversion chart
    b. Perform calculations to convert English to Metric measurement

B. **INTERPRET ENGINEERING DRAWINGS**
  1. Identify the Purpose of Listed Notes and Dimensions
    a. Interpret the notes on a blueprint or mechanical drawing
    b. Identify scale on a blueprint or mechanical drawing
    c. Identify methods of dimensioning objects:
      1) Cylinders
      2) Arcs
      3) Holes
      4) Counter bored Holes
      5) Countersink Holes
      6) Angles
    d. Simple isometric sketch
    e. Single line symbols for pipe and fittings
    f. Piping and Instrumentation Diagram (P&ID)
    g. Orthographic drawing

C. **USE MEASURING TOOLS**
  1. Record Dimensions Using the Coarse Measuring Tools Provided
    a. Rigid rules
    b. Folding rules
    c. Tape rules

**D. USE TOOLS**

1. Identify and Use Shop Hand Tools
    - a. Use and care of wrenches
    - b. Use and care of screwdrivers
    - c. Use and care of pliers and cutters
    - d. Use and care of striking tools
    - e. Use and care of bearing pullers
    - f. Use and care of threading and reaming equipment
    - g. Use and care of files
2. Identify and Use Hand Held Power Tools
    - a. Use and care portable grinders
    - b. Use and care of portable drill motors
    - c. Use and care of portable band saws
    - d. Use and care of portable reciprocating saws

**E. MAINTAIN/TROUBLESHOOT EQUIPMENT AND SYSTEMS**

1. Maintain Positive Displacement Pumps
    - a. Identify types of positive displacement pumps
        - 1) Piston
        - 2) Gear
        - 3) Vane
        - 4) Screw
        - 5) Diaphragm
        - 6) Plunger
    - b. Perform disassembly, inspection, repair and assembly of positive displacement pumps
2. Maintain Gate, Globe, Ball and Plug Valves
    - a. Identify component parts
    - b. Perform dissemble, inspection, repair and assembly
3. Maintain Hydraulics System
    - a. Identify ANSI hydraulic system drawing symbols
    - b. Perform disassembly inspection and reassemble of hydraulic system components

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in it's "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

## I. COMPETENCIES

- A. ***Resources:*** *Identifies, organizes, plans, and allocates resources*
  1. follows a schedule to complete assigned tasks on time
  2. determine the initial cost of materials and "value added" as result of work
  3. complete a stock request form for required material
  4. provide a self-evaluation of performance based on the time and quality of work
- B. ***Interpersonal:*** *Works with others*
  1. complete assigned responsibilities within the shop floor serving as a member of the team
  2. provide individual assistance/direction to peers as requested
  3. perform work to acceptable levels of quality as required
  4. works well with all members of the class
- C. ***Information:*** *Acquires and uses information*
  1. read and interpret blueprints
  2. organize and apply theories of machine tool operation
  3. perform basic semi-precision and precision layout as necessary
- D. ***Systems:*** *Understands complex inter-relationships*
  1. demonstrate knowledge of the following systems:
     - a. laboratory organization structure: physical and social
     - b. organization of personnel and facilities on the shop floor
     - c. systematic approach to the mechanical process
     - d. dimensioning and measurement systems
     - e. systematic organization of training materials
  2. monitors and corrects performance during
     - a. the practical process
     - b. adjustments of individual laboratory work schedule
     - c. constantly evaluating the quality of work to achieve acceptable standards
     - d. maintains record of evaluations and sets individual goals
- E. *Technology: Works with a variety of technologies*
  1. chooses procedure, tools and equipment required to perform the task
  2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
  3. maintains and troubleshoots equipment
     - a. applies appropriate preventative maintenance
     - b. when operating machines
     - c. reports all malfunctions of equipment to supervisor/instructor
     - d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

- A. ***Basic Skills:*** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.
  1. ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
     - a. studies student laboratory manual

   - b. interprets blueprints and technical drawings
   - c. read/studies textbook
   - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion

2. *Writing: Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
   - a. outline the steps necessary to perform a mechanical task
   - b. maintain a lecture notebook
   - c. submit written responses to chapter question assignments
   - d. complete all written assignments
3. ***Arithmetic/Mathematics:** Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
   - a. keeps a running computation of individual grade
   - b. performs mathematical computations necessary to understand course
4. ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*
   - a. assimilate classroom instruction
   - b. interpret and assimilate video instruction
   - c. observe laboratory demonstrations
   - d. seek and receive individualized instruction in the laboratory
5. ***Speaking:** Organizes ideas and communicates orally*
   - a. participates in classroom discussions
   - b. organize ideas and communicate specific questions to the instructor
   - c. verbally affirms understanding of a concept, procedure, or required skill
   - d. communicates with peers to ensure the smooth and safe operation of the laboratory

B. ***Thinking Skills:** Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*

1. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
   - a. identifies personal goals
   - b. identifies actions required to accomplish personal goals
2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
   - a. makes daily accommodations to stay on schedule
   - b. seeks additional instruction/clarification for assignment completion
   - c. balances social and academic life/responsibilities
   - d. accepts responsibility
3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
   - a. interprets technical drawings
   - b. interprets technical illustrations and symbols
   - c. understands both written and verbal instructions

    - d. assimilates process during instructor demonstrations
4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    - a. demonstrate mastery of the basic skills and techniques
    - b. use these sequential skills to support mastery of new skills
    - c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    - a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
    - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
    - c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly.

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    - c. develops an understanding good students know what they are going to do in class and does not waste time
    - d. develops a fine work-ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving technical skills
    - b. assist students with special needs as a peer mentor
    - c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    - a. maintain a record of academic achievement (individual grade book)
    - b. make accommodations to laboratory schedules due to broken equipment/tools

    c. accept the responsibility for self-management

5. *Integrity/Honesty: Chooses ethical courses of action*
    a. accept the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
    d. understand the consequences of unethical behaviors

***M**achine Tool **A**dvanced **S**kills*
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**MAST**

# COURSE SYLLABUS
# INTERPERSONAL RELATIONS AND PROFESSIONAL DEVELOPMENT

# MAST PROGRAM
## COURSE SYLLABUS
## INTERPERSONAL RELATIONS AND PROFESSIONAL DEVELOPMENT

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**Lecture hours/week: 3** **Lab hours/week: 0** **Credit hours: 3**

### COURSE DESCRIPTION:

Provides a study of human relations and professional development in today's rapidly changing world that prepares students for living and working in a complex society. Topics include: personal skills required for understanding the self and others; projecting a professional image; job acquisition skills such as conducting a job search, interviewing techniques, job applications, and resume preparation; desirable job performance skills; and desirable attitudes necessary for job retention and advancement.

**PREREQUISITE: Provisional Admission**

### REQUIRED COURSE MATERIALS:

**Textbook:** **Human Relations For Success**

### METHOD OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture and discussions.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. satisfactory perform on written, oral examinations
2. satisfactory perform on outside assignments including writing assignments
3. contribute to class discussions
4. maintain attendance per current policy

### LECTURE OUTLINE:

| Lecture Topics | Contact Hrs. |
|---|---|
| **Human Relations Skills** | 6 |
| Goal Setting | |
| Stress Management | |
| Behavior Problems | |
| Personal Instructions | |
| Problem Solving/Decision Making | |
| **Job Acquisition** | 15 |
| Job Search | |

| | |
|---|---|
| Career Goals | |
| Employment Documents | |
| Interviewing | |
| **Job Retention Skills** | **3** |
| Office Relationship | |
| Time Management | |
| **Job Advancement Skills** | **3** |
| Performance Appraisal | |
| Supervisory Chain | |
| **Professional Image Skills** | **3** |
| Image | |
| Attitude | |
| **Total Lecture Hours** | **30** |

## COURSE OBJECTIVES: SCANS COMPETENCIES

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---

The following activities will be performed by each student for successful completion of this course:

I. **COMPETENCIES**

- *A. **Resources:** Identifies, organizes, plans, and allocates resources*
    - 1. follows a schedule to complete assigned tasks on time
    - 2. determine the initial cost of materials and "value added" as result of work
    - 3. complete a stock request form for required material
    - 4. provide a self-evaluation of performance based on the time and quality of work
- *B. **Interpersonal:** Works with others*
    - 1. complete assigned responsibilities within the shop floor serving as a member of the team
    - 2. provide individual assistance/direction to peers as requested
    - 3. perform work to acceptable levels of quality as required
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- *C. **Information:** Acquires and uses information*
    - 1. read and interpret blueprints
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    - 3. perform basic semi-precision and precision layout as necessary
- *D. **Systems:** Understands complex inter-relationships*
    - 1. demonstrate knowledge of the following systems:
        - a. laboratory organization structure: physical and social

        - b. organization of personnel and facilities on the shop floor
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        - d. dimensioning and measurement systems
        - e. systematic organization of training materials
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        - a. the practical process
        - b. adjustments of individual laboratory work schedule
        - c. constantly evaluating the quality of work to achieve acceptable standards
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    - 1. chooses procedure, tools and equipment required to perform the task
    - 2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
    - 3. maintains and troubleshoots equipment
        - a. applies appropriate preventative maintenance
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        - b. interprets blueprints and technical drawings
        - c. read/studies textbook
        - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
    - *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
        - a. outline the steps necessary to perform a mechanical task
        - b. maintain a lecture notebook
        - c. submit written responses to chapter question assignments
        - d. complete all written assignments
    - *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        - a. keeps a running computation of individual grade
        - b. performs mathematical computations necessary to understand course
    - *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. assimilate classroom instruction
        - b. interpret and assimilate video instruction

c. observe laboratory demonstrations
d. seek and receive individualized instruction in the laboratory

5. ***Speaking:** Organizes ideas and communicates orally*
   a. participates in classroom discussions
   b. organize ideas and communicate specific questions to the instructor
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2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
   a. makes daily accommodations to stay on schedule
   b. seeks additional instruction/clarification for assignment completion
   c. balances social and academic life/responsibilities
   d. accepts responsibility
3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
   a. interprets technical drawings
   b. interprets technical illustrations and symbols
   c. understands both written and verbal instructions
   d. assimilates process during instructor demonstrations
4. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
   a. demonstrate mastery of the basic skills and techniques
   b. use these sequential skills to support mastery of new skills
   c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
5. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
   a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
   b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
   c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:** Exerts a high level of effort and perseveres towards goal attainment*
   a. develops an understanding that in order to be successful you must be a "good" student

   b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
   c. develops an understanding good students know what they are going to do in class and does not waste time
   d. develops a fine work-ethic

2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
   a. learns to take pride in his or her work through positive reinforcement
   b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
   c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
   a. assist classmates in improving technical skills
   b. assist students with special needs as a peer mentor
   c. share laboratory resources (machines, tools and instructor's individual attention)

4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
   a. maintain a record of academic achievement (individual grade book)
   b. make accommodations to laboratory schedules due to broken equipment/tools
   c. accept the responsibility for self-management

5. ***Integrity/Honesty:*** *Chooses ethical courses of action*
   a. accept the responsibility for own actions
   b. exhibit personal honesty at all times
   c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
   d. understand the consequences of unethical behaviors

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MAST

# COURSE SYLLABUS
# INDUSTRIAL MECHANICS II

# MAST PROGRAM
## COURSE SYLLABUS
## INDUSTRIAL MECHANICS II

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**Lecture hours/week: 3** **Lab hours/week: 7** **Credit hours: 6**

**COURSE DESCRIPTION:**

Continues the application of mechanical principles to industrial production equipment with emphasis on power transmission and mechanical components. Emphasis is placed on alignment and tension. Topics include: mechanical drive systems, couplings and alignment, clutches and brakes, linkage and levers, mechanical troubleshooting, and preventative maintenance.

**PREREQUISITE:** **Industrial Mechanics I**

**REQUIRED COURSE MATERIALS:**

| | |
|---|---|
| **Textbook 1:** | Pumps, Schoolcraft Publishing |
| **Textbook 2:** | Fluid Power, Parker |
| **Lab Manual:** | Lab Manuals are issued as a text and must be returned before Final Exam is taken. |

**Hand Tools/Quantity Required:**

| | |
|---|---|
| Tools | |
| Safety Glasses | 1 pair |
| Classroom Supplies | 1 |
| Calculator | 1 |

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference | Contact Hrs. |
|---|---|---|
| Power Transmission | Chapters 1, 2 & 3, Textbook #1 | 3 |
| Mechanical Drive Systems-Belts | Chapters 4, 5 & 6, Textbook #1 | 3 |
| Test 1 | | |
| Mechanical Drive Systems-Chains | Chapters 7, 8 & 9, Textbook #1 | 3 |
| Couplings-Alignment | Chapter 10, Textbook #1 | 3 |
| Test 2 | | |
| Portable Power Tools | Chapters 1, 2 & 3, Textbook #2 | 3 |
| Clutches and Brakes | Chapters 4, 5 & 6, Textbook #2<br>Handouts | 3 |
| Test 3 | | |
| Linkage and Levers | Chapters 7, 8 & 9, Textbook #2 | 3 |
| Preventive Maintenance | Chapter 10, Textbook #2 | 3 |
| Test 4 | | |
| Rigging | | 3 |
| Mechanical Troubleshooting | | 3 |
| Final Exam | | — |
| | **Total Lecture Hours** | **30** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Power Transmission Lab | 7 |
| Belt Drive System Lab | 7 |
| Chain Drive System Lab | 7 |
| Alignment Lab - Shaft | 7 |
| Portable Power Tool Lab | 7 |
| Clutch and Brake Lab | 7 |
| Lever and Linkage Lab | 7 |
| Additional Alignment - Coupling | 7 |
| Rigging Lab; Rope; Chain | 7 |
| Complete All Labs | 7 |
| **Total Lab Hours** | **70** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
   1. Recognize OSHA Requirements
   2. Demonstrate Use of Personal Protective Equipment

B. **APPLY MATHEMATICAL CONCEPTS**
   1. Perform Basic Arithmetic Functions
      a. Add, subtract, multiply, divide whole numbers
      b. Add, subtract, multiply, divide fractions
      c. Add, subtract, multiply, divide decimal numbers
   2. Convert Fractions/Decimals

3. Convert English to Metric Measurement
    a. Use English to Metric conversion chart
    b. Perform calculations to convert English to Metric measurement

**C. INTERPRET ENGINEERING DRAWINGS**

1. Identify the purpose of listed notes and dimensions
    a. Interpret the notes on a blueprint or mechanical drawing
    b. Identify scale on a blueprint or mechanical drawing
    c. Identify methods of dimensioning objects
        1) Cylinders
        2) Arcs
        3) Holes
        4) Counter bored Holes
        5) Countersink Holes
        6) Angles
    d. Define tolerance as used in interpretation of mechanical drawings
    e. Identify document identification code
    f. Drawing abbreviations and acronyms
    g. Interpret symbols used to illustrate surface finishes on a blueprint
2. Identify Basic Layout of Drawings
    a. Alphabet of lines
    b. Types of lines used on blueprints and mechanical drawings
    c. Identify drawing views
3. Make a Drawing Using Each of the Basic Types of Drawings Listed
    a. Simple isometric sketch
    b. Single line symbols for pipe and fittings
    c. Piping and Instrumentation Diagram (P&ID)
    d. Orthographic drawing

**D. USE MEASURING TOOLS**

1. Record Dimensions Using the Coarse Measuring Tools Provided
    a. Rigid rules
    b. Folding rules
    c. Tape rules
    d. Framing square
    e. Combination square set
    f. Feeler gage
    g. Fixed gages
    h. Wire and sheet metal gages
    i Gage blocks
    j. Plasti-gage
    k. Pitch gage
2. Record Dimensions Using the Precision Measuring Tools Provided
    a. Outside calipers
    b. Inside calipers
    c. Dividers
    d. Vernier calipers
    e. Inside micrometer
    f. Outside micrometer
    g. Depth micrometer

- h. Hole gage
- i. Telescoping gage
- j. Thread micrometer
- k. Dial indicators
- l. Torque wrenches
- m. Devices used to measure temperature
- n. Bourdon tube
- o. Inspection of a torque wrench

3. Use Metric and English Standard of Measurement

**E. USE TOOLS**

1. Identify and Use Shop Hand Tools
   - a. Use and care of wrenches
   - b. Use and care of screwdrivers
   - c. Use and care of pliers and cutters
   - d. Use and care of striking tools
   - e. Use and care of bearing pullers
   - f. Use and care of threading and reaming equipment
   - g. Use and care of files
2. Identify and Use Hand Held Power Tools
   - a. Use and care of portable grinders
   - b. Use and care of portable drill motors
   - c. Use and care of portable band saws
   - d. Use and care of portable reciprocating saws

**F. OPERATE MACHINE TOOLS**

1. Use and Care of Pressure Tools
2. Use and Care for Horizontal and Vertical Band Saws
3. Use and Care for Pedestal Grinders
4. Use and Care for Surface Grinders
5. Use and Care for Lathes
6. Use and Care for Radial Arm Drill Press

**G. REPAIR POWER TRANSMISSION SYSTEMS**

1. Belt Drives
   - a. Characteristics of pulley, sheaves, and belts
   - b. Safety precautions associated with inspecting pulleys, sheaves, and belts
   - c. Inspection criteria for pulleys/sheaves and belts
   - d. Adjustment of pulleys/sheaves and belts
   - e. Remove, inspect and install pulleys, belts and sheaves
   - f. Determine direction of rotation of the output shaft
2. Gear Drives
   - a. List inspection criteria for a gear assembly
   - b. Remove, clean, inspect and install a gear assembly
3. Chain Drives
   - a. List inspection criteria for a gear assembly
   - b. Remove, clean, inspect and install a chain drive assembly
   - c. Set tension on a chain drive assembly

**H. BASIC RIGGING**

1. Rigging Fundamentals
2. Demonstrate Basic Rigging Skills

I. **OPERATE HOISTING EQUIPMENT**
  1. Demonstrate proper use of hoisting equipment
    a. Monorail hoist
    b. Chain falls
    c. Tuggers/Come-alongs

J. **BEARING MAINTENANCE**
  1. Remove and install a journal bearing
  2. Remove and install an anti-friction (roller) bearings
  3. Install and remove a thrust bearing
  4. Identify typical cause of bearing failure
  5. Gather vibration analysis data
    a. Determine sources of vibration
    b. Determine vibration specifications
    c. Determine vibration test points
    d. Obtain vibration readings using vibration analysis equipment

K. **ALIGN SHAFTS**
  1. Define terms relative to shaft alignment
    a. alignment
    b. misalignment
    c. running clearance
    d. shaft run out
    e. soft foot
    f. shaft torsion play
    g. electrical center
    h. total indicator reading
    i. 00 alignment
    j. target
    k. tolerance
    l. rough alignment
    m. non-repeating misalignment
  2. Perform alignment using feeler gauges and straight edge
  3. Perform alignment using single and reverse indicators

L. **MAINTAIN ELECTRICAL DEVICES**
  1. Use electrical test equipment

## COURSE OBJECTIVES: SCANS COMPETENCIES

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---

The following activities will be performed by each student for successful completion of this course:

## I. COMPETENCIES

A. ***Resources:** Identifies, organizes, plans, and allocates resources*
   1. follows a schedule to complete assigned tasks on time
   2. determine the initial cost of materials and "value added" as result of work
   3. complete a stock request form for required material
   4. provide a self-evaluation of performance based on the time and quality of work

B. ***Interpersonal:** Works with others*
   1. complete assigned responsibilities within the shop floor serving as a member of the team
   2. provide individual assistance/direction to peers as requested
   3. perform work to acceptable levels of quality as required
   4. works well with all members of the class

C. ***Information:** Acquires and uses information*
   1. read and interpret blueprints
   2. organize and apply theories of machine tool operation
   3. perform basic semi-precision and precision layout as necessary

D. ***Systems:** Understands complex inter-relationships*
   1. demonstrate knowledge of the following systems:
      a. laboratory organization structure: physical and social
      b. organization of personnel and facilities on the shop floor
      c. systematic approach to the mechanical process
      d. dimensioning and measurement systems
      e. systematic organization of training materials
   2. monitors and corrects performance during
      a. the practical process
      b. adjustments of individual laboratory work schedule
      c. constantly evaluating the quality of work to achieve acceptable standards
      d. maintains record of evaluations and sets individual goals

E. ***Technology:** Works with a variety of technologies*
   1. chooses procedure, tools and equipment required to perform the task
   2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
   3. maintains and troubleshoots equipment
      a. applies appropriate preventative maintenance
      b. when operating machines
      c. reports all malfunctions of equipment to supervisor/instructor
      d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

A. ***Basic Skills:** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
   1. ***Reading:** Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
      a. studies student laboratory manual
      b. interprets blueprints and technical drawings

        - c. read/studies textbook
        - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
    - 2. ***Writing:** Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
        - a. outline the steps necessary to perform a mechanical task
        - b. maintain a lecture notebook
        - c. submit written responses to chapter question assignments
        - d. complete all written assignments
    - 3. ***Arithmetic/Mathematics:** Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        - a. keeps a running computation of individual grade
        - b. performs mathematical computations necessary to understand course
    - 4. ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. assimilate classroom instruction
        - b. interpret and assimilate video instruction
        - c. observe laboratory demonstrations
        - d. seek and receive individualized instruction in the laboratory
    - 5. ***Speaking**: Organizes ideas and communicates orally*
        - a. participates in classroom discussions
        - b. organize ideas and communicate specific questions to the instructor
        - c. verbally affirms understanding of a concept, procedure, or required skill
        - d. communicates with peers to ensure the smooth and safe operation of the laboratory
- *B.* ***Thinking Skills:** Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    - 1. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        - a. identifies personal goals
        - b. identifies actions required to accomplish personal goals
    - 2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
        - a. makes daily accommodations to stay on schedule
        - b. seeks additional instruction/clarification for assignment completion
        - c. balances social and academic life/responsibilities
        - d. accepts responsibility
    - 3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
        - a. interprets technical drawings
        - b. interprets technical illustrations and symbols
        - c. understands both written and verbal instructions
        - d. assimilates process during instructor demonstrations

4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
    - a. demonstrate mastery of the basic skills and techniques
    - b. use these sequential skills to support mastery of new skills
    - c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    - a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
    - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
    - c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    - c. develops an understanding good students know what they are going to do in class and does not waste time
    - d. develops a fine work-ethic
2. ***Self-Esteem:*** *Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:*** *Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving technical skills
    - b. assist students with special needs as a peer mentor
    - c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:*** *Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    - a. maintain a record of academic achievement (individual grade book)
    - b. make accommodations to laboratory schedules due to broken equipment/tools
    - c. accept the responsibility for self-management
5. ***Integrity/Honesty:*** *Chooses ethical courses of action*

a. accept the responsibility for own actions
b. exhibit personal honesty at all times
c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
d. understand the consequences of unethical behaviors

IMT 110
02/081396

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

# MAST

## COURSE SYLLABUS
# INDUSTRIAL PNEUMATICS

# MAST PROGRAM
## COURSE SYLLABUS
## INDUSTRIAL PNEUMATICS

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**Lecture hours/week: 3** **Lab hours/week: 2** **Credit hours: 4**

### COURSE DESCRIPTION:

Provides instruction in fundamental concepts and theories for the safe operation of pneumatic components and systems. Topics include: pneumatic theory, preventative maintenance, compressors, regulators, pneumatic valves, actuators, servicing safety and troubleshooting.

**PREREQUISITE: Industrial Hydraulics**

### REQUIRED COURSE MATERIALS:

**Textbook:** Industrial Pneumatic Technology, Parker Fluid Power.
**Lab Manual:** Industrial Pneumatic Technology, Parker Fluid Power. Lab Manuals are issued as a text and must be returned before Final Exam is taken.

| **Hand Tools/Quantity Required:** | |
|---|---|
| Tool Box | 1 |
| Safety Glasses | 1 pair |
| Classroom Supplies | 1 |
| Calculator | 1 |

### METHOD OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Evolution of Compressed Air Force Transmission | | 3 |
| Energy Transmission Using a Pneumatic System | | 3 |
| Control of Pneumatic Energy | | |
| Test 1 | | |
| Compressors | | 3 |
| Test 2 | | |
| Aftercoolers, Dryers, Receives-Air Distribution System | | 3 |
| Check Valves, Cylinders, Motors | | 3 |
| Directional Control Valves | | 3 |
| Test 3 | | |
| Flow Control Valves, Silencers, Quick Exhaust | | 3 |
| Test 4 | | |
| Regulators, Boosters and Sequence Valves | | 3 |
| Air Preparation | | 3 |
| Final Exam | | 3 |
| | **Total Lecture Hours** | **30** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Complete Practical Exercise on Force Transmission | 2 |
| Complete Practical Exercise on Control of Pneumatic Energy | 2 |
| Complete Practical Exercise on Compressors | 2 |
| Complete Practical Exercise on Air Distribution System | 2 |
| Complete Practical Exercise on Cylinders | 2 |
| Complete Practical Exercise on Directional Control Valves | 2 |
| Complete Practical Exercise on Sequence Valves | 2 |
| Complete Practical Exercise on Air Preparation | 2 |
| **Total Lab Hours** | **20** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

**A. PRACTICE SAFETY**

1. Follow Safety Manuals and All Safety Regulations/Requirements
    - a. Assume responsibility for the personal safety of oneself and others
    - b. Develop a personal attitude towards safety
    - c. Interpret safety manual directives
    - d. Comply with established company safety practices

2. Use Protective Equipment
    a. Wear protective safety clothing as required
    b. Maintain and use protective guards and equipment on machinery
    c. Locate and properly use protective equipment
    d. Use lifting aids when necessary
3. Follow Safe Operating Procedures for Hand and Machine Tools
    a. Identify and understand safe machine operating procedures
    b. Demonstrate safe machine operation
4. Maintain a Clean and Safe Work Environment
    a. Keep work areas clean
    b. Clean machine/hand tools when work is completed
    c. Put tools away when work is finished
    d. Keep aisles clear of equipment and materials

## B. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Functions
    a. Add, subtract, multiply and divide whole numbers
    b. Add, subtract, multiply, and divide fractions
    c. Add, subtract, multiply, and divide decimals
2. Convert Fractions/Decimals
    a. Convert fractions to decimal equivalents
    b. Convert decimal values to nearest fractional equivalent
    c. Use Decimal Equivalent Chart for conversions
3. Convert Metric/English Measurements
    a. Convert English dimensions to Metric
    b. Convert Metric dimensions to English
    c. Use Metric/English conversion chart

## C. INTERPRET ENGINEERING DRAWINGS AND CONTROL DOCUMENTS

1. Review Blueprint Notes and Dimensions
    a. Explain basic blueprint terminology
    b. Identify the types of dimensions
    c. Identify general note symbols
    d. Locate notes on a print
    e. Interpret commonly used abbreviations and terminology
    f. Determine tolerances associated with dimensions on a drawing
    g. Determine the tolerance for a reference dimension
    h. Determine the surface finish for a given part
    i. List the essential components found in the general drawing notes
2. Identify Basic Layout of Drawings
    a. Identify types of lines within a drawing
    b. Identify item number symbols
    c. Identify general note symbols
    d. List the essential components found in the title block
    e. Locate bill of materials in a drawing
    f. List the components found in the revision block
3. Identify Basic Types of Drawings
    a. Identify orthographic views
    b. Identify positions of views (top, front, side, and auxiliary)
    c. Visualize one or more views from a given view

  - d. Identify isometric views
  - e. Identify exploded isometric drawings
  - f. Identify assembly drawings
- 4. List the Purpose of Each Type of Drawing
  - a. Identify the purpose of orthographic (3 views) drawings
  - b. Identify the purpose of isometric drawing
  - c. Identify the purpose of exploded isometric drawing
  - d. Identify the purpose of assembly drawings
- 5. Verify Drawing Elements
  - a. Determine the scale of the view or section
  - b. Check for revisions
  - c. Recognize out-of-date blueprints
- 6. Describe the Relationship of Engineering Drawings to Planning
  - a. Discuss production schedule
  - b. Discuss Material Resource Planning (MRP)
  - c. Discuss inventory control records
- 7. Use Standards to Verify Requirements
  - a. Discuss the purpose of standards
  - b. Discuss source locations for standards
- 8. Analyze Bill of Materials (BOM)
  - a. Discuss components found on BOM
  - b. Determine materials needed to produce the part
  - c. Determine quantities necessary to produce the part
  - d. Submit completed stock request form as required
  - e. Submit completed tool request form as needed

**D. RECOGNIZE DIFFERENT MANUFACTURING MATERIALS AND PROCESSES**

- 1. Identify Materials With Desired Properties
  - a. Discuss classification system for metals

**E. PERFORM MEASUREMENT/INSPECTION**

- 1. Identify Types of Measurement Used in the Shop
  - a. Distinguish between direct and calculated measurements
  - b. Compute calculated measurements
  - c. Justify the use of measurements in manufacturing
  - d. Discuss the following: precision, reliability, and accuracy
  - e. Demonstrate general measurement techniques
  - f. Demonstrate semi-precision measurement techniques
  - g. Demonstrate precision measurement techniques
  - h. Document results of measurement activities and calculations
- 2. Select Proper Measurement Tools
  - a. Match appropriate measurement tools with various types of measurement requirements
  - b. Demonstrate proper measurement tool usage
  - c. List steps of proper measurement
  - d. Explain rationale for each step
  - e. Identify error possibilities in measurement tool selection
  - f. Identify error possibilities within measurement procedures
  - g. Identify common conversion error possibilities

        - h. Discriminate between accepted measurement procedures and improper measurement procedures
    - 3. Apply Proper Measuring Techniques
        - a. Explain calibration requirements of various precision instruments
        - b. Illustrate measurement differences when taken with calibrated and non-calibrated instruments
        - c. Justify use of particular measurement tools based on tool characteristics
        - d. Discuss factors affecting accurate measurement (i.e., dirt, temperature, etc.)
    - 4. Use Metric and English Standards of Measurement
        - a. Discuss the English system of measurement
        - b. Discuss the Metric system of measurement
    - 5. Perform Measurements With Hand Held Instruments
        - a. Measure with steel rules (metric and inch)
        - b. Measure with micrometers
        - c. Measure with comparison measuring instruments (i.e., calipers, telescope gages)
        - d. Measure with direct measuring instruments (i.e., vernier, dial, and digital instruments)
        - e. Measure with fixed gages (go and not go gages)

**F. MAINTAIN/TROUBLESHOOT EQUIPMENT AND SYSTEMS**

- 1. Maintain Pneumatic Control Circuit
    - a. Troubleshoot a pneumatic circuit
- 2. Maintain Gate, Globe, Ball and Plug Valves
    - a. Identify component parts
    - b. Perform dissemble, inspection, repair and assembly

**G. REPAIR POWER TRANSMISSION SYSTEMS**

- 1. Belt Drives
    - a. Characteristics of pulley, sheaves, and belts
    - b. Safety precautions associated with inspecting pulleys, sheaves, and belts
    - c. Inspection criteria for pulleys/sheaves and belts
    - d. Adjustment of pulleys/sheaves and belts
    - e. Remove, inspect and install pulleys, belts and sheaves
    - f. Determine direction of rotation of the output shaft

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

---

The following activities will be performed by each student for successful completion of this course:

## I. COMPETENCIES

- A. *Resources: Identifies, organizes, plans, and allocates resources*
  - 1. follows a schedule to complete assigned tasks on time
  - 2. determine the initial cost of materials and "value added" as result of work
  - 3. complete a stock request form for required material
  - 4. provide a self-evaluation of performance based on the time and quality of work
- B. *Interpersonal: Works with others*
  - 1. complete assigned responsibilities within the shop floor serving as a member of the team
  - 2. provide individual assistance/direction to peers as requested
  - 3. perform work to acceptable levels of quality as required
  - 4. works well with all members of the class
- C. *Information: Acquires and uses information*
  - 1. read and interpret blueprints
  - 2. organize and apply theories of machine tool operation
  - 3. perform basic semi-precision and precision layout as necessary
- D. *Systems: Understands complex inter-relationships*
  - 1. demonstrate knowledge of the following systems:
    - a. laboratory organization structure: physical and social
    - b. organization of personnel and facilities on the shop floor
    - c. systematic approach to the mechanical process
    - d. dimensioning and measurement systems
    - e. systematic organization of training materials
  - 2. monitors and corrects performance during
    - a. the practical process
    - b. adjustments of individual laboratory work schedule
    - c. constantly evaluating the quality of work to achieve acceptable standards
    - d. maintains record of evaluations and sets individual goals
- E. *Technology: Works with a variety of technologies*
  - 1. chooses procedure, tools and equipment required to perform the task
  - 2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
  - 3. maintains and troubleshoots equipment
    - a. applies appropriate preventative maintenance
    - b. when operating machines
    - c. reports all malfunctions of equipment to supervisor/instructor
    - d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

- A. *Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  - 1. *Reading: Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    - a. studies student laboratory manual
    - b. interprets blueprints and technical drawings

    - c. read/studies textbook
    - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
  - 2. *Writing: Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    - a. outline the steps necessary to perform a mechanical task
    - b. maintain a lecture notebook
    - c. submit written responses to chapter question assignments
    - d. complete all written assignments
  - 3. ***Arithmetic/Mathematics:** Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    - a. keeps a running computation of individual grade
    - b. performs mathematical computations necessary to understand course
  - 4. ***Listening:** Receives, attends to, interprets, and responds to verbal messages and other cues*
    - a. assimilate classroom instruction
    - b. interpret and assimilate video instruction
    - c. observe laboratory demonstrations
    - d. seek and receive individualized instruction in the laboratory
  - 5. ***Speaking**: Organizes ideas and communicates orally*
    - a. participates in classroom discussions
    - b. organize ideas and communicate specific questions to the instructor
    - c. verbally affirms understanding of a concept, procedure, or required skill
    - d. communicates with peers to ensure the smooth and safe operation of the laboratory
- B. ***Thinking Skills:** Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
  - 1. ***Decision Making:** Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    - a. identifies personal goals
    - b. identifies actions required to accomplish personal goals
  - 2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
    - a. makes daily accommodations to stay on schedule
    - b. seeks additional instruction/clarification for assignment completion
    - c. balances social and academic life/responsibilities
    - d. accepts responsibility
  - 3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
    - a. interprets technical drawings
    - b. interprets technical illustrations and symbols
    - c. understands both written and verbal instructions
    - d. assimilates process during instructor demonstrations

- *4. **Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
    - a. demonstrate mastery of the basic skills and techniques
    - b. use these sequential skills to support mastery of new skills
    - c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
- *5. **Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    - a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
    - b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
    - c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

*C. **Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

- *1. **Responsibility:** Exerts a high level of effort and perseveres towards goal attainment*
    - a. develops an understanding that in order to be successful you must be a "good" student
    - b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    - c. develops an understanding good students know what they are going to do in class and does not waste time
    - d. develops a fine work-ethic
- *2. **Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    - a. learns to take pride in his or her work through positive reinforcement
    - b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    - c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
- *3. **Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    - a. assist classmates in improving technical skills
    - b. assist students with special needs as a peer mentor
    - c. share laboratory resources (machines, tools and instructor's individual attention)
- *4. **Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    - a. maintain a record of academic achievement (individual grade book)
    - b. make accommodations to laboratory schedules due to broken equipment/tools
    - c. accept the responsibility for self-management
- *5. **Integrity/Honesty:** Chooses ethical courses of action*

a. accept the responsibility for own actions
b. exhibit personal honesty at all times
c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
d. understand the consequences of unethical behaviors

*M*achine Tool *A*dvanced *S*kills
*T*echnology Program

MAST

# COURSE SYLLABUS
# REFRIGERATION FUNDAMENTALS

# MAST PROGRAM
## COURSE SYLLABUS
## REFRIGERATION FUNDAMENTALS

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**Lecture hours/week: 3** **Lab hours/week: 2** **Credit hours: 4**

**COURSE DESCRIPTION:**

This course introduces the basic concepts and theories of refrigeration. Topics include: the laws of thermodynamics, pressure and temperature relationships, heat transfer, the refrigeration cycle and safety.

**PREREQUISITE:** **NONE**

**REQUIRED COURSE MATERIALS:**

| | |
|---|---|
| **Textbook 1** | Modern Refrigeration and Air Conditioning, Althouse et al. |
| **Textbook 2** | Study Guide for Modern Refrigeration and Air Conditioning, Althouse et al. |

**Hand Tools/Quantity Required:**

- 3 ring notebook
- #2 pencil
- Goggles-flexible fitting
- Hooded ventilation
- Pocket thermometer - 40 to 60 degrees Fahrenheit

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| **Laws of Thermodynamics** | | 7 |
| First law of thermodynamics | | |
| Second law of thermodynamics | | |
| Definition of refrigeration terms and purposes | | |
| **Pressure and Temperature Relationships** | | 6 |
| Definition of pressure | | |
| Relationship of pressure and temperature - P.T. chart | | |
| Pressure - Atmospheric, gauge and absolute | | |
| Gas laws | | |
| **Heat and Heat Transfer** | | 6 |
| Definitions of heat and temperature | | |
| Temperatures - Fahrenheit, Celsius, and absolute | | |
| Heat - Specific, sensible and latent | | |
| **Refrigeration Cycle** | | 8 |
| Condensation | | |
| Evaporation | | |
| System Components | | |
| Basic refrigeration cycle | | |
| **Safety** | | 3 |
| General shop safety | | |
| Emergency procedures | | |
| | **Total Lecture Hours** | 30 |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| **Laws of Thermodynamics** | 5 |
| **Pressure and Temperature Relationships** | 5 |
| **Heat and Heat Transfer** | 5 |
| **Refrigeration Cycle** | 5 |
| **Total Lab Hours** | 20 |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. PRACTICE SAFETY
  1. Recognize OSHA Requirements
  2. Demonstrate Use of Personal Protective Equipment

B. APPLY MATHEMATICAL CONCEPTS

1. Perform Basic Arithmetic Functions
    - a. Add, subtract, multiply, divide whole numbers
    - b. Add, subtract, multiply, divide fractions
    - c. Add, subtract, multiply, divide decimal numbers
2. Convert Fractions /Decimals
3. Convert English to Metric Measurement
    - a. Use English to Metric conversion chart
    - b. Perform calculations to convert English to Metric measurement
4. Perform Basic Algebraic Operations
5. Perform Basic Geometric Calculations
    - a. Calculate area, per

**C. USE TOOLS**

1. Identify and Use Shop Hand Tools
    - a. Use and care of wrenches
    - b. Use and care of screwdrivers
    - c. Use and care of pliers and cutters
    - d. Use and care of striking tools
    - e. Use and care of bearing pullers
    - f. Use and care of threading and reaming equipment
    - g. Use and care of files
2. Identify and Use Hand Held Power Tools
    - a. Use and care portable grinders
    - b. Use and care of portable drill motors
    - c. Use and care of portable band saws
    - d. Use and care of portable reciprocating saws

**D. MAINTAIN/TROUBLESHOOT EQUIPMENT AND SYSTEMS**

1. Maintain Air Conditioning System
    - a. Describe the refrigeration cycle

**E. FABRICATE/INSTALL SHEET METAL PARTS**

1. Layout Sheet Metal Parts
    - a. Precautions associated with handling sheet metal
    - b. Sheet metal tools and materials
    - c. Gauge scale used for material thickness
    - d. Characteristics/applications of metals used in sheet metal fabrication:
2. Form/Bend Sheet Metal Parts
    - a. Use a metal brake
    - b. Use a roller
    - c. Use a nibbler
3. Fasten Sheet Metal Parts
    - a. Use a seamer
    - b. Select and use proper fasteners

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These* *are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

## I. COMPETENCIES

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. determine the initial cost of materials and "value added" as result of work
    3. complete a stock request form for required material
    4. provide a self-evaluation of performance based on the time and quality of work
- *B.* ***Interpersonal:*** *Works with others*
    1. complete assigned responsibilities within the shop floor serving as a member of the team
    2. provide individual assistance/direction to peers as requested
    3. perform work to acceptable levels of quality as required
    4. works well with all members of the class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and interpret blueprints
    2. organize and apply theories of machine tool operation
    3. perform basic semi-precision and precision layout as necessary
- *D.* ***Systems:*** *Understands complex inter-relationships*
    1. demonstrate knowledge of the following systems:
        - a. laboratory organization structure: physical and social
        - b. organization of personnel and facilities on the shop floor
        - c. systematic approach to the mechanical process
        - d. dimensioning and measurement systems
        - e. systematic organization of training materials
    2. monitors and corrects performance during
        - a. the practical process
        - b. adjustments of individual laboratory work schedule
        - c. constantly evaluating the quality of work to achieve acceptable standards
        - d. maintains record of evaluations and sets individual goals
- *E.* ***Technology:*** *Works with a variety of technologies*
    1. chooses procedure, tools and equipment required to perform the task
    2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
    3. maintains and troubleshoots equipment
        - a. applies appropriate preventative maintenance
        - b. when operating machines
        - c. reports all malfunctions of equipment to supervisor/instructor
        - d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  - *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    - a. studies student laboratory manual
    - b. interprets blueprints and technical drawings
    - c. read/studies textbook
    - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
  - *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    - a. outline the steps necessary to perform a mechanical task
    - b. maintain a lecture notebook
    - c. submit written responses to chapter question assignments
    - d. complete all written assignments
  - *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    - a. keeps a running computation of individual grade
    - b. performs mathematical computations necessary to understand course
  - *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    - a. assimilate classroom instruction
    - b. interpret and assimilate video instruction
    - c. observe laboratory demonstrations
    - d. seek and receive individualized instruction in the laboratory
  - *5.* ***Speaking*****:** *Organizes ideas and communicates orally*
    - a. participates in classroom discussions
    - b. organize ideas and communicate specific questions to the instructor
    - c. verbally affirms understanding of a concept, procedure, or required skill
    - d. communicates with peers to ensure the smooth and safe operation of the laboratory
- *B.* ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
  - *1.* ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    - a. identifies personal goals
    - b. identifies actions required to accomplish personal goals
  - *2.* ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
    - a. makes daily accommodations to stay on schedule
    - b. seeks additional instruction/clarification for assignment completion
    - c. balances social and academic life/responsibilities
    - d. accepts responsibility

3. *Seeing Things In the Mind's Eye: Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interprets technical drawings
    b. interprets technical illustrations and symbols
    c. understands both written and verbal instructions
    d. assimilates process during instructor demonstrations
4. *Knowing How to Learn: Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of the basic skills and techniques
    b. use these sequential skills to support mastery of new skills
    c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
5. *Reasoning: Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
    b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
    c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly.

C. *Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*

1. *Responsibility: Exerts a high level of effort and perseveres towards goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work-ethic
2. *Self-Esteem: Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. *Sociability: Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. share laboratory resources (machines, tools and instructor's individual attention)
4. *Self-Management: Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. maintain a record of academic achievement (individual grade book)

b. make accommodations to laboratory schedules due to broken equipment/tools
c. accept the responsibility for self-management

*5. Integrity/Honesty: Chooses ethical courses of action*

a. accept the responsibility for own actions
b. exhibit personal honesty at all times
c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
d. understand the consequences of unethical behaviors

***M**achine Tool **A**dvanced **S**kills*
***T**echnology Program*

# MAST

## COURSE SYLLABUS

# METAL WELDING & CUTTING TECHNIQUES

**Prerequisite: Provisional Admission**

# MAST PROGRAM

## COURSE SYLLABUS

## METAL WELDING AND CUTTING TECHNIQUES

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**Lecture hours/week: 2** **Lab hours/week: 3** **Credit hours: 3**

### COURSE DESCRIPTION:

Provides instruction in the fundamental use of the electric arc welder and the oxyacetylene cutting outfit. Emphasis is placed on safe setup and use of equipment. Topics include: arc welding, flame cutting, safety practices, oxyfuel welding, and brazing.

**PREREQUISITE:** **Provisional Admission**

### REQUIRED COURSE MATERIALS:

**Textbook:** Welding Principles & Applications
**Lab Manual:** Welding Principles & Applications

**Hand Tools/Quantity Required:**
- Welding Hood
- Safety Gloves for Welding
- Safety Vest for Welding

### METHOD OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

### LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| **Arc Welding** | | 4 |
| Principles and Terminology | | |

| | |
|---|---|
| Applications | |
| Safe Operating Procedures | |
| Metal Joints and Preparation | |
| Arc Weld | |
| **Flame Cutting** | 5 |
| Principles and Terminology | |
| Applications | |
| Safe Operating Procedures | |
| Work Preparation | |
| Flame Cutting | |
| **Safety Practices** | 6 |
| General | |
| Arc Welding Applications | |
| First Aid | |
| **Oxyfuel Welding** | 3 |
| Principles and Terminology | |
| Applications | |
| Safe Operating Procedures | |
| Metal Joints and Preparation | |
| Oxyfuel Weld | |
| **Brazing** | 2 |
| Principles and Terminology | |
| Applications | |
| Safe Operating Procedures | |
| Metal Joints and Preparation | |
| Braze Metal | |
| **Total Lecture Hours** | **20** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| **Arc Welding** | **8** |
| **Flame Cutting** | **7** |
| **Safety Practices** | **1** |
| **Oxyfuel Welding** | **7** |
| **Brazing** | **7** |
| **Total Lab Hours** | **30** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
  1. Recognize OSHA Requirements
  2. Demonstrate Use of Personal Protective Equipment

B. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Functions
    a. Add, subtract, multiply, divide whole numbers
    b. Add, subtract, multiply, divide fractions

    - c. Add, subtract, multiply, divide decimal numbers
  - 2. Convert Fractions/Decimals
  - 3. Perform Basic Algebraic Operations
  - 4. Perform Basic Trigonometric Functions
  - 5. Perform Basic Geometric Calculations
    - a. Calculate area

**C. INTERPRET ENGINEERING DRAWINGS**

  - 1. Identify the Purpose of Listed Notes and Dimensions
    - a. Interpret the notes on a blueprint or mechanical drawing
    - b. Identify scale on a blueprint or mechanical drawing
    - c. Identify methods of dimensioning objects
      - 1) Cylinders
      - 2) Arcs
      - 3) Holes
      - 4) Counter bored Holes
      - 5) Countersink Holes
      - 6) Angles
      - 7) Circle Centers
    - d. Define tolerance as used in interpretation of mechanical drawings
    - e. Identify document identification code.
    - f. Drawing abbreviations and acronyms
    - g. Interpret symbols used to illustrate surface finishes on a blueprint
  - 2. Identify Basic Layout of Drawings
    - a. Alphabet of lines
    - b Types of lines used on blueprints and mechanical drawings
    - c. Identify drawings views
  - 3. Make a Drawing Using Each of the Basic Types of Drawings Listed
    - a. Simple isometric sketch
    - b. Single line symbols for pipe and fittings
    - c. Piping and Instrumentation Diagram (P&ID)
    - d. Orthographic drawing

**D. USE MEASURING TOOLS**

  - 1. Record Dimensions Using the Coarse Measuring Tools Provided
    - a. Rigid rules
    - b. Folding rules
    - c. Tape rules
    - d. Framing square
    - e. Combination square set
    - f. Feeler gage
    - g. Fixed gages
    - h. Wire and sheet metal gages
    - i Gage blocks
    - j. Plasti-gage
    - k. Pitch gage
  - 2. Record Dimensions Using the Precision Measuring Tools Provided
    - a. Outside calipers
    - b. Inside calipers
    - c. Dividers
    - d. Vernier calipers

        - e. Inside micrometer
        - f. Outside micrometer
        - g. Depth micrometer
        - h. Hole gage
        - i Telescoping gage
        - j. Thread micrometer
        - k. Dial indicators
        - l. Torque wrenches
        - m. Devices used to measure temperature
        - n. Bourdon tube
        - o. Inspection of a torque wrench
    - 3. Use Metric and English Standard of Measurement

**E. USE TOOLS**

- 1. Identify and Use Shop Hand Tools
    - a. Use and care of wrenches
    - b. Use and care of screwdrivers
    - c. Use and care of pliers and cutters
    - d. Use and care of striking tools
    - e. Use and care of bearing pullers
    - f. Use and care of threading and reaming equipment
    - g. Use and care of files
- 2. Identify and Use Hand Held Power Tools
    - a. Use and care portable grinders
    - b. Use and care of portable drill motors
    - c. Use and care of portable band saws
    - d. Use and care of portable reciprocating saws

**F. OPERATE MACHINE TOOLS**

- 1. Use and Care for Surface Grinders
- 2. Use and Care for Lathes

**G. PERFORM WELDING OPERATIONS**

- 1. Weld with Shielded Metal Arc Welding (SMAW)
    - a. Set up a welding machine for (SMAW) operation
    - b. Prepare weld joint
    - c. Weld flat plate in any position
    - d. Weld pipe from 45 degree position
    - e. Recognize a weld defect
    - f. Properly clean a weld joint for inspection
- 2. Weld and Cut with Oxyacetylene
    - a. % of different gases found in the atmosphere
    - b Oxy/acetylene welding components and their function
    - c. Safely handle, transport, and secure gas cylinders
    - d. Cause of regulator creep
    - e. Identify safe withdrawal rate of acetylene from gas cylinder
    - f. Recognize indications of overheating of ferrous and nonferrous materials
    - g. Use temperature sticks
    - h. List inspection criteria for the oxy/acetylene outfit
    - i. Properly setup and adjust oxy/acetylene system
    - j. Use oxy/acetylene to cut and weld
- 3. Gas Soldering

        - a. Specialized tools used with soldering
        - b. Purpose of fluxes
        - c. Temperature range for soldering
        - d. Purpose of tinning
        - e. Safety precautions associated with sweat soldering

**H. PIPEFITTING OPERATIONS**

1. Perform Basic Pipefitting Calculations
2. Cut and Thread Pipe Using Hand Operated Pipe Cutter, Reamer and Die
3. Assemble Pipe with Threaded Flanges
4. Install and Adjust Pipe Support
5. Use Flaring Equipment
6. Bend Metal Tubing
7. Join Plastic Pipe Using Cement

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in it's "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

---

The following activities will be performed by each student for successful completion of this course:

**I. COMPETENCIES**

- *A.* ***Resources:*** *Identifies, organizes, plans, and allocates resources*
    1. follows a schedule to complete assigned tasks on time
    2. determine the initial cost of materials and "value added" as result of work
    3. complete a stock request form for required material
    4. provide a self-evaluation of performance based on the time and quality of work
- *B.* ***Interpersonal:*** *Works with others*
    1. complete assigned responsibilities within the shop floor serving as a member of the team
    2. provide individual assistance/direction to peers as requested
    3. perform work to acceptable levels of quality as required
    4. works well with all members of the class
- *C.* ***Information:*** *Acquires and uses information*
    1. read and interpret blueprints
    2. organize and apply theories of machine tool operation
    3. perform basic semi-precision and precision layout as necessary
- *D.* ***Systems:*** *Understands complex inter-relationships*
    1. demonstrate knowledge of the following systems:
        - a. laboratory organization structure: physical and social
        - b. organization of personnel and facilities on the shop floor

        - c. systematic approach to the mechanical process
        - d. dimensioning and measurement systems
        - e. systematic organization of training materials
    - 2. monitors and corrects performance during
        - a. the practical process
        - b. adjustments of individual laboratory work schedule
        - c. constantly evaluating the quality of work to achieve acceptable standards
        - d. maintains record of evaluations and sets individual goals
- *E.* ***Technology:*** *Works with a variety of technologies*
    - 1. chooses procedure, tools and equipment required to perform the task
    - 2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
    - 3. maintains and troubleshoots equipment
        - a. applies appropriate preventative maintenance
        - b. when operating machines
        - c. reports all malfunctions of equipment to supervisor/instructor
        - d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

- *A.* ***Basic Skills:*** *Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
    - *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
        - a. studies student laboratory manual
        - b. interprets blueprints and technical drawings
        - c. read/studies textbook
        - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
    - *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
        - a. outline the steps necessary to perform a mechanical task
        - b. maintain a lecture notebook
        - c. submit written responses to chapter question assignments
        - d. complete all written assignments
    - *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
        - a. keeps a running computation of individual grade
        - b. performs mathematical computations necessary to understand course
    - *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
        - a. assimilate classroom instruction
        - b. interpret and assimilate video instruction
        - c. observe laboratory demonstrations
        - d. seek and receive individualized instruction in the laboratory

5. ***Speaking:*** *Organizes ideas and communicates orally*
    a. participates in classroom discussions
    b. organize ideas and communicate specific questions to the instructor
    c. verbally affirms understanding of a concept, procedure, or required skill
    d. communicates with peers to ensure the smooth and safe operation of the laboratory

B. ***Thinking Skills:*** *Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn and reasons.*
    1. ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
        a. identifies personal goals
        b. identifies actions required to accomplish personal goals
    2. ***Problem Solving:*** *Recognizes problems and devises and implements plan of action*
        a. makes daily accommodations to stay on schedule
        b. seeks additional instruction/clarification for assignment completion
        c. balances social and academic life/responsibilities
        d. accepts responsibility
    3. ***Seeing Things In the Mind's Eye:*** *Organizes, and processes symbols, pictures, graphs, objects, and other information*
        a. interprets technical drawings
        b. interprets technical illustrations and symbols
        c. understands both written and verbal instructions
        d. assimilates process during instructor demonstrations
    4. ***Knowing How to Learn:*** *Use efficient learning techniques to acquire and apply new knowledge and skills*
        a. demonstrate mastery of the basic skills and techniques
        b. use these sequential skills to support mastery of new skills
        c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
    5. ***Reasoning:*** *Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
        a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
        b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
        c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly.

C. ***Personal Qualities:*** *Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
    1. ***Responsibility:*** *Exerts a high level of effort and perseveres towards goal attainment*
        a. develops an understanding that in order to be successful you must be a "good" student
        b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work

c. develops an understanding good students know what they are going to do in class and does not waste time
d. develops a fine work-ethic

2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee
3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. maintain a record of academic achievement (individual grade book)
    b. make accommodations to laboratory schedules due to broken equipment/tools
    c. accept the responsibility for self-management
5. ***Integrity/Honesty:** Chooses ethical courses of action*
    a. accept the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
    d. understand the consequences of unethical behaviors

*M*achine Tool *A*dvanced *S*kills
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MAST

# COURSE SYLLABUS
# LATHE OPERATIONS I

# MAST PROGRAM
## COURSE SYLLABUS
## LATHE OPERATIONS I

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**Lecture hours/week: 4** **Lab hours/week: 6** **Credit hours: 7**

**COURSE DESCRIPTION:**

Provides opportunities for students to develop skill in the use of bench grinders and lathes. Topics include: lathes, bench grinders, bench grinder operations, lathe calculations, lathe setup, and lathe operations.

**PREREQUISITE:** **Provisional Admission**

**REQUIRED COURSE MATERIALS:**

**Textbook:** **Technology of Machine Tools**
**Lab Manual:** **Technology of Machine Tools**

**Hand Tools/Quantity Required:**
Hand Tools
Calculator

**METHOD OF INSTRUCTION:**

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

**LECTURE OUTLINE:**

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Lathes | | 10 |

| | |
|---|---|
| Lathe Parts | |
| Lathe Controls | |
| Lathe Lubrication System | |
| Lathe Maintenance | |
| Blueprint Reading | |
| **Bench Grinders** | 3 |
| Wheel Selection | |
| **Bench Grinder Operations** | 2 |
| Sharpening | |
| Grinding | |
| **Lathe Calculations** | 10 |
| Speeds and Feeds | |
| Tooling Requirements | |
| Other Calculations (Tapers, Threads, Drilling) | |
| **Lathe Setup** | 10 |
| Setup | |
| **Lathe Operations** | 5 |
| Operations | — |
| **Total Lecture Hours** | 40 |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| **Lathes** | 3 |
| **Bench Grinders** | 2 |
| **Bench Grinder Operations** | 5 |
| **Lathe Calculations** | 5 |
| **Lathe Setup** | 15 |
| **Lathe Operations** | 10 |
| **Total Lab Hours** | 40 |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
  1. Recognize OSHA Requirements
  2. Demonstrate Use of Personal Protective Equipment

B. **APPLY MATHEMATICAL CONCEPTS**
  1. Perform Basic Arithmetic Functions
    a. Add, subtract, multiply, divide whole numbers
    b. Add, subtract, multiply, divide fractions
    c. Add, subtract, multiply, divide decimal numbers
  2. Convert Fractions/Decimals
  3. Convert English to Metric Measurement
    a. Use English to Metric conversion chart
    b. Perform calculations to convert English to Metric measurement

4. Perform Basic Algebraic Operations

**C. USE MEASURING TOOLS**

1. Record Dimensions Using the Coarse Measuring Tools Provided
    a. Rigid rules
    b. Folding rules
    c. Tape rules
    d. Framing square
    e. Combination square set
    f. Feeler gage
    g. Fixed gages
    h. Wire and sheet metal gages
    i. Gage blocks
    j. Plasti-gage
    k. Pitch gage
2. Record Dimensions Using the Precision Measuring Tools Provided
    a. Outside calipers
    b. Inside calipers
    c. Dividers
    d. Vernier calipers
    e. Inside micrometer
    f. Outside micrometer
    g. Depth micrometer
    h. Hole gage
    i. Telescoping gage
    j. Thread micrometer
    k. Dial indicators
    l. Torque wrenches
    m. Devices used to measure temperature
    n. Bourdon tube
    o. Inspection of a torque wrench

**D. USE TOOLS**

1. Identify and Use Shop Hand Tools
    a. Use and care of wrenches
    b. Use and care of screwdrivers
    c. Use and care of pliers and cutters
    d. Use and care of striking tools
    e. Use and care of bearing pullers
    f. Use and care of threading and reaming equipment
    g. Use and care of files
2. Identify and Use Hand Held Power Tools
    a. Use and care portable grinders
    b. Use and care of portable drill motors
    c. Use and care of portable band saws
    d. Use and care of portable reciprocating saws

**E. OPERATE MACHINE TOOLS**

1. Use and Care of Pressure Tools
2. Use and Care for Pedestal Grinders

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

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The following activities will be performed by each student for successful completion of this course:

I. COMPETENCIES
    A. *Resources: Identifies, organizes, plans, and allocates resources*
        1. follows a schedule to complete assigned tasks on time
        2. determine the initial cost of materials and "value added" as result of work
        3. complete a stock request form for required material
        4. provide a self-evaluation of performance based on the time and quality of work
    B. *Interpersonal: Works with others*
        1. complete assigned responsibilities within the shop floor serving as a member of the team
        2. provide individual assistance/direction to peers as requested
        3. perform work to acceptable levels of quality as required
        4. works well with all members of the class
    C. *Information: Acquires and uses information*
        1. read and interpret blueprints
        2. organize and apply theories of machine tool operation
        3. perform basic semi-precision and precision layout as necessary
    D. *Systems: Understands complex inter-relationships*
        1. demonstrate knowledge of the following systems:
            a. laboratory organization structure: physical and social
            b. organization of personnel and facilities on the shop floor
            c. systematic approach to the mechanical process
            d. dimensioning and measurement systems
            e. systematic organization of training materials
        2. monitors and corrects performance during
            a. the practical process
            b. adjustments of individual laboratory work schedule
            c. constantly evaluating the quality of work to achieve acceptable standards
            d. maintains record of evaluations and sets individual goals
    E. *Technology: Works with a variety of technologies*
        1. chooses procedure, tools and equipment required to perform the task
        2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
        3. maintains and troubleshoots equipment

    a. applies appropriate preventative maintenance
    b. when operating machines
    c. reports all malfunctions of equipment to supervisor/instructor
    d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

A. *Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*

- *1.* ***Reading:*** *Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
    - a. studies student laboratory manual
    - b. interprets blueprints and technical drawings
    - c. read/studies textbook
    - d. follow a daily laboratory schedule to maintain appropriate time-line and task completion
- *2.* ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
    - a. outline the steps necessary to perform a mechanical task
    - b. maintain a lecture notebook
    - c. submit written responses to chapter question assignments
    - d. complete all written assignments
- *3.* ***Arithmetic/Mathematics:*** *Perform basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques*
    - a. keeps a running computation of individual grade
    - b. performs mathematical computations necessary to understand course
- *4.* ***Listening:*** *Receives, attends to, interprets, and responds to verbal messages and other cues*
    - a. assimilate classroom instruction
    - b. interpret and assimilate video instruction
    - c. observe laboratory demonstrations
    - d. seek and receive individualized instruction in the laboratory
- *5.* ***Speaking:*** *Organizes ideas and communicates orally*
    - a. participates in classroom discussions
    - b. organize ideas and communicate specific questions to the instructor
    - c. verbally affirms understanding of a concept, procedure, or required skill
    - d. communicates with peers to ensure the smooth and safe operation of the laboratory

B. *Thinking Skills: Thinks creatively, makes* decisions, solves problems, visualizes, knows how to learn and reasons.

- *1.* ***Decision Making:*** *Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative*
    - a. identifies personal goals
    - b. identifies actions required to accomplish personal goals

2. ***Problem Solving:** Recognizes problems and devises and implements plan of action*
    a. makes daily accommodations to stay on schedule
    b. seeks additional instruction/clarification for assignment completion
    c. balances social and academic life/responsibilities
    d. accepts responsibility
3. ***Seeing Things In the Mind's Eye:** Organizes, and processes symbols, pictures, graphs, objects, and other information*
    a. interprets technical drawings
    b. interprets technical illustrations and symbols
    c. understands both written and verbal instructions
    d. assimilates process during instructor demonstrations
4. ***Knowing How to Learn:** Use efficient learning techniques to acquire and apply new knowledge and skills*
    a. demonstrate mastery of the basic skills and techniques
    b. use these sequential skills to support mastery of new skills
    c. understand the sequential nature of acquired skills and the subsequent knowledge application of new skills and techniques
5. ***Reasoning:** Discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem*
    a. understands that practice may not make it perfect but it certainly will improve the skill of the operator
    b. understands that the quality of the product is a function of the time of the operation and the attitude and skill of the machinist
    c. understands the relationship between different metals and the tool applied to the metal surface and adjusts machining parameters accordingly

C. ***Personal Qualities:** Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty.*
1. *Responsibility: Exerts a high level of effort and perseveres towards goal attainment*
    a. develops an understanding that in order to be successful you must be a "good" student
    b. develops an understanding that a "good" student is the one who is prompt to every class and has prepared for the day's work
    c. develops an understanding good students know what they are going to do in class and does not waste time
    d. develops a fine work-ethic
2. ***Self-Esteem:** Believes in own self-worth and maintains a positive view of self*
    a. learns to take pride in his or her work through positive reinforcement
    b. sees himself or herself as an asset to the class through continued contributions to the group and a shared common goal
    c. understands that an individual with a positive attitude and the belief in their own abilities will systematically seek solutions and be a valuable employee

3. ***Sociability:** Demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings*
    a. assist classmates in improving technical skills
    b. assist students with special needs as a peer mentor
    c. share laboratory resources (machines, tools and instructor's individual attention)
4. ***Self-Management:** Assesses self accurately, sets personal goals, monitors progress, and exhibits self-control*
    a. maintain a record of academic achievement (individual gradebook)
    b. make accommodations to laboratory schedules due to broken equipment/tools
    c. accept the responsibility for self-management
5. ***Integrity/Honesty:** Chooses ethical courses of action*
    a. accept the responsibility for own actions
    b. exhibit personal honesty at all times
    c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
    d. understand the consequences of unethical behaviors

**_M_achine Tool _A_dvanced _S_kills**
**_T_echnology Program**

# MAST

# COURSE SYLLABUS
# INDUSTRIAL MAINTENANCE-MECHANICAL REVIEW

# MAST PROGRAM

## COURSE SYLLABUS

## INDUSTRIAL MAINTENANCE-MECHANICAL REVIEW

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**Lecture hours/week: 1** **Lab hours/week: 4** **Credit hours: 3**

### COURSE DESCRIPTION:

Provides an instructional review of the Industrial Maintenance course of study with a comprehensive assessment of each area. The assessment will consist of a written, identification, and hands on examination. Topics include: Math, alternating current, direct current motors, refrigeration, pumps and piping systems, hydraulics, pneumatics, lathe operations, mechanics, welding and safety.

**PREREQUISITE/COREQUISITE:** **All Program Courses**

### REQUIRED COURSE MATERIALS:

**Textbook :** All previous books
**Lab Manual:** All previous books

**Hand Tools/Quantity Required:**

| | |
|---|---|
| Tools | 1 set |
| Safety Glasses | 1 pair |
| Classroom Supplies | 1 |
| Calculator | 1 |

### METHOD OF INSTRUCTION:

**Lecture:** Didactic presentations will include lecture, video and demonstrations.

**Laboratory:** Laboratory will be a "hands-on" process.

**Method of Evaluation**: A student's grade will be based on multiple measures of performance. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability to:

1. perform the manipulative skills of the craft as required to satisfactorily complete laboratory assignments
2. apply theory to laboratory assignments
3. satisfactorily perform on written, oral, and practical examinations
4. satisfactorily perform on outside assignments including writing assignments
5. contribute to class discussions
6. maintain attendance per current policy
7. follow all shop rules and safety regulations as stated in the laboratory manual

## LECTURE OUTLINE:

| Lecture Topics | Text Reference Page | Contact Hrs. |
|---|---|---|
| Diagnostic Test, Safety, AC & DC Circuits | | 1 |
| Math, Motor Controls | | 1 |
| Pneumatics, Pumps and Piping Systems | | 1 |
| Test 1 | | |
| Rebuild Air Compressor (Project 1) | | 1 |
| Rebuild Air Compressor (Project 1) (continued) | | 1 |
| Test 2 | | |
| Complete All Assignments and Project 1 | | 1 |
| Mechanics | | 1 |
| Hydraulics | | 1 |
| Test 3 | | |
| Lathe Operations, Welding | | 1 |
| Refrigeration | | 1 |
| Complete All Assignments | | |
| Final Exam | | — |
| | **Total Lecture Hours** | **10** |

## LAB OUTLINE:

| Lab Topics | Contact Hrs. |
|---|---|
| Rebuild Air Compressor | 12 |
| Rebuild Pump | 12 |
| Troubleshoot Motor Control | 8 |
| Troubleshoot Lathe | 4 |
| Troubleshoot Refrigeration System | 4 |
| **Total Lab Hours** | **40** |

## COURSE OBJECTIVES: TECHNICAL COMPETENCIES

After the successful completion of this course the student will be able to:

A. **PRACTICE SAFETY**
   1. Follow Safety Manuals and All Safety Regulations/Requirements
      a. Assume responsibility for the personal safety of oneself and others
      b. Develop a personal attitude towards safety
      c. Interpret safety manual directives
      d. Comply with established company safety practices
   2. Use Protective Equipment
      a. Wear protective safety clothing as required
      b. Maintain and use protective guards and equipment on machinery
      c. Locate and properly use protective equipment
      d. Use lifting aids when necessary
   3. Follow Safe Operating Procedures for Hand and Machine Tools

a. Identify and understand safe machine operating procedures
b. Demonstrate safe machine operation

4. Maintain a Clean and Safe Work Environment
   a. Keep work areas clean
   b. Clean machine/hand tools when work is completed
   c. Put tools away when work is finished
   d. Keep aisles clear of equipment and materials

**B. APPLY MATHEMATICAL CONCEPTS**

1. Perform Basic Arithmetic Functions
   a. Add, subtract, multiply and divide whole numbers
   b. Add, subtract, multiply, and divide fractions
   c. Add, subtract, multiply, and divide decimals
2. Convert Fractions/Decimals
   a. Convert fractions to decimal equivalents
   b. Convert decimal values to nearest fractional equivalent
   c. Use Decimal Equivalent Chart for conversions
3. Convert Metric/English measurements
   a. Convert English dimensions to Metric
   b. Convert Metric dimensions to English
   c. Use Metric/English conversion chart
4. Perform Basic Trigonometric Functions
   a. Solve for unknown angles
   b. Solve for unknown sides
5. Calculate Speeds and Feeds for Machining
   a. Calculate RPM for various metals and various tools
   b. Calculate feed for various metals, tools, and depths of cut
6. Locate Machining Points from a Datum Point
   a. Identify points using the Cartesian coordinate system
   b. Identify points using the absolute dimensioning system
   c. Identify points using the incremental dimensioning system

**C. INTERPRET ENGINEERING DRAWINGS AND CONTROL DOCUMENTS**

1. Review Blueprint Notes and Dimensions
   a. Explain basic blueprint terminology
   b. Identify the types of dimensions
   c. Identify general note symbols
   d. Locate notes on a print
   e. Interpret commonly used abbreviations and terminology
   f. Determine tolerances associated with dimensions on a drawing
   g. Determine the tolerance for a reference dimension
   h. Determine the surface finish for a given part
   i. List the essential components found in the general drawing notes
2. Identify Basic Layout of Drawings
   a. Identify types of lines within a drawing
   b. Identify item number symbols
   c. Identify general note symbols
   d. List the essential components found in the title block
   e. Locate bill of materials in a drawing
   f. List the components found in the revision block

3. Identify Basic Types of Drawings
    a. Identify orthographic views
    b. Identify positions of views (top, front, side, and auxiliary)
    c. Visualize one or more views from a given view
    d. Identify isometric views
    e. Identify exploded isometric drawings
    f. Identify assembly drawings
4. List the Purpose of Each Type of Drawing
    a. Identify the purpose of orthographic (3 views) drawings
    b. Identify the purpose of isometric drawing
    c. Identify the purpose of exploded isometric drawing
    d. Identify the purpose of assembly drawings
5. Verify Drawing Elements
    a. Determine the scale of the view or section
    b. Check for revisions
    c. Recognize out-of-date blueprints
6. Practice Geometric Dimensioning and Tolerancing (GD&T) Methodology
    a. Identify the purpose of GD&T
    b. Identify symbols for controlling location (or true position) of part features
    c. Identify symbols for controlling form (or alignment) of part features
    d. Identify symbols for showing datums and basic dimensions on drawings
    e. Identify symbols for Maximum Material Size (MMS) and Regardless of Feature Size (RFS)
7. Describe the Relationship of Engineering Drawings to Planning
    a. Discuss production schedule
    b. Discuss Material Resource Planning (MRP)
    c. Discuss inventory control records
8. Use Standards to Verify Requirements
    a. Discuss the purpose of standards
    b. Discuss source locations for standards
9. Analyze Bill of Materials (BOM)
    a. Discuss components found on BOM
    b. Determine materials needed to produce the part
    c. Determine quantities necessary to produce the part
    d. Submit completed stock request form as required
    e. Submit completed tool request form as needed

**D. RECOGNIZE DIFFERENT MANUFACTURING MATERIALS AND PROCESSES**

1. Identify Materials With Desired Properties
    a. Discuss classification system for metals

**E. PERFORM MEASUREMENT/INSPECTION**

1. Identify Types of Measurement Used in the Machine Shop
    a. Distinguish between direct and calculated measurements
    b. Compute calculated measurements
    c. Justify the use of precision measurements in manufacturing
    d. Discuss the following: precision, reliability , and accuracy
    e. Demonstrate general measurement techniques
    f. Demonstrate semi-precision measurement techniques

    - g. Demonstrate precision measurement techniques
    - h. Document results of measurement activities and calculations
  - 2. Select Proper Measurement Tools
    - a. Match appropriate measurement tools with various types of measurement requirements
    - b. Demonstrate proper measurement tool usage
    - c. List steps of proper measurement
    - d. Explain rationale for each step
    - e. Identify error possibilities in measurement tool selection
    - f. Identify error possibilities within measurement procedures
    - g. Identify common conversion error possibilities
    - h. Discriminate between accepted measurement procedures and improper measurement procedures
  - 3. Apply Proper Measuring Techniques
    - a. Explain calibration requirements of various precision instruments
    - b. Illustrate measurement differences when taken with calibrated and non-calibrated instruments
    - c. Justify use of particular measurement tools based on tool characteristics
    - d. Discuss factors affecting accurate measurement (i.e., dirt, temperature, etc.)
  - 4. Use Metric and English Standards of Measurement
    - a. Discuss the English system of measurement
    - b. Discuss the Metric system of measurement
  - 5. Perform Measurements With Hand Held Instruments
    - a. Measure with steel rules (metric and inch)
    - b. Measure with micrometers
    - c. Measure with comparison measuring instruments (i.e., calipers, telescope gages)
    - d. Measure with direct measuring instruments (i.e., vernier, dial, and digital instruments)
    - e. Measure with fixed gages (go and not go gages)
  - 6. Perform Measurements on Surface Plate
    - a. Describe care of surface plate
    - b. Use surface plate accessories correctly (sine bar, gage blocks, etc.)
    - c. Check for part squareness
    - d. Check part dimensions for accuracy
    - e. Align work pieces using height gage and dial indicators

**F. PERFORM CONVENTIONAL MACHINING OPERATIONS**

  - 1. Prepare and Plan For Machining Operations
    - a. Read and interpret blueprints
    - b. Perform basic semi-precision and precision layout as necessary
    - c. Plan machining operations
    - d. Understand machinability and chip formation
    - e. Calculate speeds, feeds, and depth of cut for various machine applications
    - f. Determine proper cutting fluids/coolants for machining
    - g. Use carbides and other tool materials to increase productivity
    - h. Use the Machinery's Handbook as a reference for machine applications
  - 2. Use Proper Hand Tools

- a. Use arbor and shop presses
- b. Select necessary work-holding devices and hand tools as needed
- c. Select and use hand files
- d. Identify and use hand reamers
- e. Correctly identify and use hand taps as required
- f. Follow tapping procedures to produce internal threads
- g. Use thread-cutting dies to produce external threads
- h. Operate bench and pedestal grinders safely

3. Operate Power Saws
   - a. Use reciprocating and horizontal band cutoff machines
   - b. Prepare and use the vertical band saw
4. Operate Drill Presses
   - a. Describe the different types of drill presses found in the machine shop
   - b. Describe and use standard drilling tools
   - c. Sharpen a drill bit using a bench or pedestal grinder
   - d. Setup the drill presses for drilling, countersinking, counter boring, reaming, and tapping operations
5. Operate Vertical Milling Machines
   - a. Demonstrate the use of all controls on the vertical milling machine
   - b. Align the vertical milling machine head
   - c. Select, align and use work holding devices
   - d. Select milling tool holders
   - e. Select milling cutters
   - f. Perform all standard vertical milling operations
6. Operate Metal Cutting Lathes
   - a. Demonstrate the use of all controls on the engine lathe
   - b. Discuss standard tools and toolholder for the lathe
   - c. Face and center drill parts correctly
   - d. Drill, ream and bore on the lathe
   - e. Make all calculations, lathe adjustments and settings to machine sixty-degree external threads
   - f. Discuss thread fit classifications
   - g. Use HSS cutting tools
   - h. Use carbide cutting tools

## COURSE OBJECTIVES: SCANS COMPETENCIES

*The Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, has identified in its "AMERICA 2000 REPORT" that all students should develop a new set of competencies and foundation skills if they are to enjoy a productive, full and satisfying life. These are in addition to the Technical Workplace Competencies required by industry. SCANS is made up of five competencies and a three-part foundation of skills and personal qualities that are needed for solid job performance.*

---

The following activities will be performed by each student for successful completion of this course:

## I. COMPETENCIES

A. ***Resources:** Identifies, organizes, plans, and allocates resources*
  1. follows a schedule to complete assigned tasks on time
  2. determine the initial cost of materials and "value added" as result of work
  3. complete a stock request form for required material
  4. provide a self-evaluation of performance based on the time and quality of work

B. ***Interpersonal:** Works with others*
  1. complete assigned responsibilities within the shop floor serving as a member of the team
  2. provide individual assistance/direction to peers as requested
  3. perform work to acceptable levels of quality as required
  4. works well with all members of the class

C. ***Information:** Acquires and uses information*
  1. read and interpret blueprints
  2. organize and apply theories of machine tool operation
  3. perform basic semi-precision and precision layout as necessary

D. ***Systems:** Understands complex inter-relationships*
  1. demonstrate knowledge of the following systems:
     a. laboratory organization structure: physical and social
     b. organization of personnel and facilities on the shop floor
     c. systematic approach to the mechanical process
     d. dimensioning and measurement systems
     e. systematic organization of training materials
  2. monitors and corrects performance during
     a. the practical process
     b. adjustments of individual laboratory work schedule
     c. constantly evaluating the quality of work to achieve acceptable standards
     d. maintains record of evaluations and sets individual goals

E. ***Technology:** Works with a variety of technologies*
  1. chooses procedure, tools and equipment required to perform the task
  2. applies appropriate procedures and uses appropriate tools and equipment to perform the mechanical task to acceptable standards
  3. maintains and troubleshoots equipment
     a. applies appropriate preventative maintenance
     b. when operating machines
     c. reports all malfunctions of equipment to supervisor/instructor
     d. perform clean-up assignments of equipment and shop floor at the end of the laboratory

## II. FOUNDATION SKILLS

A. ***Basic Skills:** Reads, writes, performs arithmetic and mathematical operations, listens and speaks.*
  1. ***Reading:** Locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules*
     a. studies student laboratory manual
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        c. read/studies textbook
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    2. ***Writing:*** *Communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts*
        a. outline the steps necessary to perform a mechanical task
        b. maintain a lecture notebook
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        c. balances social and academic life/responsibilities
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        b. interprets technical illustrations and symbols
        c. understands both written and verbal instructions
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b. exhibit personal honesty at all times
c. accept the challenge of doing your own work in the laboratory, during examination, and on outside assignments
d. understand the consequences of unethical behaviors

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02/081396

# APPENDIX A - INDUSTRY COMPETENCY PROFILES

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The following pages contain the individual Competency Profiles for each of the companies surveyed by the MAST development center for the occupational specialty area of . These Competency Profiles/skill standards were used to develop the curriculum for the pilot program.

The participation of the companies as partners in the MAST effort is greatly appreciated. Each company has approved the use of its logo in MAST materials. None of the participating companies shall be held responsible or liable for any of the findings of the project.

### SKILLS AND KNOWLEDGE

- Communication Skills
- Use Measurement Tools
- Use Inspection Devices
- Mathematical Skills
- Reading/Writing Skills
- Knowledge of Safety Regulations
- Practice Safety in the Workplace
- Organizational Skills
- Knowledge of Company Policies/Procedures
- Mechanical Aptitude
- Ability to Comprehend Written/Verbal Instructions
- Knowledge of Cutting Fluids/Lubricants
- Basic Knowledge of Fasteners
- Ability to Work as Part of a Team
- Converse in the Technical Language of the Trade
- Knowledge of Occupational Opportunities
- Knowledge of Employee/Employer Responsibilities
- Knowledge of Company Quality Assurance Activities
- Practice Quality-Consciousness in Performance of the Job

### TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

DR. HUGH K. ROGERS
Director

DR. JON BOTSFORD
Assistant Director

JOE PENICK
Project Coordinator

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

**Furnished By:**

**MICHAEL CANADA**
Assistant Director of Manufacturing

**RICHARD M. WONG**
Sr. Manufacturing Engineer

**ODIE ROBINSON**

**HERMAN PRECELLA**
First Electrician

Texas State
Technical College
Waco

### TRAITS AND ATTITUDES

- Strong Work Ethic
- Interpersonal Skills
- Punctuality
- Dependability
- Honesty
- Neatness
- Safety Conscientious
- Motivation
- Responsible
- Physical Ability
- Professional
- Trustworthy
- Customer Relations
- Personal Ethics

### TOOLS AND EQUIPMENT

- Electrician's Tools (lineman pliers, wire strippers, screwdrivers, etc.)
- Electric Drills and Saws
- Conduit Threading Equipment
- Measuring Tools
- Volt-Ohm-Meters
- Tachometers
- Amp Meters (Clamp On)
- Power Supplies
- Oscilloscopes
- Signal Generators
- Power Distribution Center
- Computers
- Basic Drafting Tools
- Electrical Lighting Equipment
- Electrical Switches
- Electro-Mechanical Devices (Control Relays, Timers, Contactors, Motor Starters, etc.)
- Manual and Hydraulic Conduit Benders
- Electrical Panelboards
- Hazardous Location Equipment
- Wire Pulling Equipment
- AC Motors
- DC Motors
- Servo Motors
- Alternators and Generators
- Motor/Generator Logic Controllers
- Transits
- Transformers
- Transformer Test Sets
- Motor Control Center
- Motor Control Troubleshooting Trainers
- Switchgear
- Protective Metering and Relaying Test Equipment
- AC Drives
- DC Drives
- Servo Drives
- Variable Speed Controls

### FUTURE TRENDS AND CONCERNS

- Advanced Computer Applications
- Fiber Optic Controls
- Advanced Test Equipment
- Robotics
- Advanced Metering Control

## COMPETENCY PROFILE

# Electrical Systems Technician

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

BOWEN
®

BEST COPY AVAILABLE

**ELECTRICAL SYSTEMS TECHNICIAN....uses knowledge and skills to install, maintain, and troubleshoot electrical/electronic equipment in residential, commercial, and industrial environments.**

| | Duties | ← Tasks → | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **Practice Electrical Safety** | A-1 Keep one hand free when possible | A-2 Wear designated safety equipment | A-3 Use tag, lock and try procedures | A-4 Maintain CPR certification | A-5 When possible, turn off power when testing devices | A-6 Keep metal tools from high voltage areas | A-7 Work with a partner on high voltage jobs | A-8 Practice ladder safety | A-9 Use full protection equipment as requested | A-10 Use safe operating procedures with chemicals and gases | | | |
| **B** | **Perform Basic Mathematical Skills** | B-1 Add, subtract, multiply and divide numbers | B-2 Calculate perimeters, areas and volumes | B-3 Use measurement conversion tables | B-4 Solve basic algebraic equations | | | | | | | | | |
| **C** | **Perform Basic Electrical Functions** | C-1 Measure/ calculate DC resistance, current and voltages | C-2 Measure/ calculate power in DC circuits | C-3 Read wire tables and find amperage/ resistance | C-4 Measure/ calculate AC currents, voltages and impedance | C-5 Measure power factor in AC circuits | | | | | | | | |
| **D** | **Use Basic Hand and Power Tools** | D-1 Measure with inch and metric rulers | D-2 Use screwdrivers, regular and ball peen hammers | D-3 Use crescent wrench, socket drives, lineman pliers | D-4 Use hacksaws, wire stripper, try square, nut driver | D-5 Use tie wrap gun, hex wrenches, channel lock pliers | D-6 Use diagonal cutting pliers, sheet metal snips | D-7 Use hole cutters | D-8 Use drills and reamers | | | | | |
| **E** | **Maintain DC Motors** | E-1 Use a tachometer to check speed | E-2 Understand differences between series, shunt & compound connected DC motors | E-3 Inspect motor for signs of damage and wear | E-4 Inspect brushes and replace if necessary | E-5 Troubleshoot motors using name plate data | E-6 Disconnect and reconnect motors to the power source | E-7 Identify frame type | E-8 Repair and maintain motor controls | | | | | |
| **F** | **Maintain Single Phase Motors** | F-1 Use a tachometer to check speed | F-2 Understand types of induction motors, i.e., split phase | F-3 Understand types of induction motors, i.e., capacitor start | F-4 Understand types of induction motors, i.e., capacitor run | F-5 Understand types of induction motors, i.e., shaded pole | F-6 Understand types of induction motors, i.e., squirrel cage | F-7 Understand types of induction motors, i.e., wound rotor | F-8 Understand synchronous motor operation | F-9 Inspect motor for signs of damage and wear | F-10 Troubleshoot motors using name plate data | F-11 Disconnect and reconnect motors | F-12 Identify frame and type | F-13 Repair and maintain motor controls |
| **G** | **Maintain Three Phase Motors** | G-1 Recognize the Wye and Delta configurations | G-2 Troubleshoot motors using name plate data | G-3 Connect and disconnect motors, including dual voltage nine lead machines | G-4 Identify frame type | G-5 Repair and maintain variable speed drives | G-6 Repair and maintain motor controls | | | | | | | |
| **H** | **Read Basic Blueprints, Drawings and Schematics** | H-1 Read circuit diagram schematics | H-2 Read wiring diagrams, including single line diagrams | H-3 Read ladder logic diagrams | H-4 Read digital logic diagrams | | | | | | | | | |
| **I** | **Use Basic Electrical Metering Equipment** | I-1 Use digital and analog ammeters | I-2 Use clamp-on ammeters | I-3 Use digital and analog voltmeters or read wattmeters | I-4 Use meggers and insulation testers | I-5 Calibrate and repair electronic scales, loadcells | I-6 Use variable power supplies | I-7 Use probes and strobes for testing machine accuracy | | | | | | |
| **J** | **Test Common Parts and Replace If Necessary** | J-1 Test and replace single and three phase contactors | J-2 Test and replace motor starters | J-3 Test and replace overload devices | J-4 Test and replace relays and timers | J-5 Test and replace switches, i.e., SPST/ SPDT/DPST/ DPDT limit | J-6 Test and replace switches, i.e., micro, pushbutton, cam, and rotary | J-7 Test and replace switches, i.e., level and flow switches | J-8 Test and replace capacitors, coils, control transformers | J-9 Test and replace starting resistors, wire runs, lights, and switch gear | J-10 Test and replace fuses, circuit breakers and disconnects | J-11 Test and replace diodes, transistors, SCRs | J-12 Test and replace measuring instruments, i.e., varmeters, wattmeters | J-13 Test and replace voltmeters ammeters |

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|  | Duties | Tasks |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Maintain Transformers | K-1 Understand basic transformer operation | K-2 Measure transformer voltages and currents | K-3 Test transformer with prescribed equipment and change oils | K-4 Replace/repair transformer coils and taps | K-5 Disconnect and connect transformers from the line |  |  |  |  |  |  |  |  |
| L | Troubleshoot PLCs | L-1 Understand PLC status indicators | L-2 Use PLCs to test input contacts and sensors | L-3 Read PLC line inputs and output conditions | L-4 Read PLC timer, counter information | L-5 Test input and output modules and replace if necessary |  |  |  |  |  |  |  |  |
| M | Test/Repair Communication Systems | M-1 Test/repair various types of microphones, amplifiers/speakers | M-2 Maintain RF devices | M-3 Install fiber optic cable | M-4 Install twisted pair cable | M-5 Install co-axial cable | M-6 Maintain video monitor equipment |  |  |  |  |  |  |  |
| N | Understand Basic Troubleshooting Techniques | N-1 Follow power source to final device operation | N-2 Use ohmmeter for continuity checks | N-3 Check voltage/current levels against specification | N-4 Check wiring against diagram | N-5 Analyze possible causes of problem using schematic diagram | N-6 Use isolation to identify problem area | N-7 Troubleshoot overhead cranes, including gears and tracks |  |  |  |  |  |  |
| O | Use Computer | O-1 Calibrate metal sensors | O-2 Operate power system via P.C. | O-3 Print out data report | O-4 Input data | O-5 Make inquiry via P.C. | O-6 Search/clear alarms | O-7 Use E-mail |  |  |  |  |  |  |
| P | Perform Electrical Repair on NC and CNC Machine | P-1 Operate mechanical mills and lathes | P-2 Operate NC and CNC machine | P-3 Troubleshoot with LED lights and tech manuals/tapes | P-4 Repair or replace switch, wiring or electric motors |  |  |  |  |  |  |  |  |  |

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Knowledge of Cutting Fluids/Lubricants
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

## TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

**DR. HUGH ROGERS**
Director

**DR. JON BOTSFORD**
Assistant Director

**JOE PENICK**
Project Coordinator

**TERRY SAWMA**
Research Coordinator

**WALLACE PELTON**
Site Coordinator

**ROSE MARY TIMMONS**
Senior Secretary/Statistician

### Furnished By:

**RICKY FLAK**
Vice President - Operations

**NICK NICHOLS**
Manufacturing Manager -
Diamond Products

**JACE FELTON**
Reliability Engineer and
Electrical Technician

Texas State
Technical College
Waco

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Electrician's Tools (lineman pliers, wire strippers, screwdrivers, etc.)
Electric Drills and Saws
Conduit Threading Equipment
Measuring Tools
Volt-Ohm-Meters
Tachometers
Amp Meters (Clamp On)
Power Supplies
Oscilloscopes
Signal Generators
Power Distribution Center
Computers
Basic Drafting Tools
Electrical Lighting Equipment
Electrical Switches
Electro-Mechanical Devices (Control Relays, Timers, Contactors, Motor Starters, etc.)
Manual and Hydraulic Conduit Benders
Electrical Panelboards
Hazardous Location Equipment
Wire Pulling Equipment
AC Motors
DC Motors
Servo Motors
Alternators and Generators
Motor/Generator Logic Controllers
Transits
Transformers
Transformer Test Sets
Motor Control Center
Motor Control Troubleshooting Trainers
Switchgear
Protective Metering and Relaying Test Equipment
AC Drives
DC Drives
Servo Drives

## FUTURE TRENDS AND CONCERNS

Advanced Computer Applications
Fiber Optic Controls
Advanced Test Equipment
Robotics
Advanced Metering Control
Networking of Shop Floor Devices

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## COMPETENCY PROFILE

# Electrical Systems Technician

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

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**ELECTRICAL SYSTEMS TECHNICIAN....uses knowledge and skills to install, maintain, and troubleshoot electrical/electronic equipment in residential, commercial, and industrial environments.**

| Duties | | ← Tasks → | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Electrical Safety | A-1 Keep one hand free when possible | A-2 Wear designated safety equipment | A-3 Use tag, lock and try procedures | A-4 Maintain CPR certification | A-5 When possible, turn off power when testing devices | A-6 Keep metal tools from high voltage areas | A-7 Work with a partner on high voltage jobs | A-8 Practice ladder safety | A-9 Use full protection equipment as requested | A-10 Practice safety in the use of all power tools | | | |
| B | Perform Basic Mathematical Skills | B-1 Add, subtract, multiply and divide numbers | B-2 Calculate perimeters, areas and volumes | B-3 Use measurement conversion tables | B-4 Solve basic algebraic equations | | | | | | | | | |
| C | Perform Basic Electrical Functions | C-1 Measure/ calculate DC resistance, current and voltages | C-2 Measure/ calculate power in DC circuits | C-3 Read wire tables and find amperage/ resistance | C-4 Measure/ calculate AC currents, voltages and impedance | C-5 Measure power factor in AC circuits | C-6 Calculate and determine configurations for transformers | | | | | | | |
| D | Use Basic Hand and Power Tools | D-1 Measure with inch and metric rulers | D-2 Use screwdrivers, regular and ball peen hammers | D-3 Use crescent wrench, socket drives and lineman pliers | D-4 Use hacksaws, wire stripper, try square, and nut driver | D-5 Use tie wrap gun, hex wrenches and channel lock pliers | D-6 Use diagonal cutting pliers and sheet metal snips | D-7 Use hole cutters | D-8 Use drills and reamers | D-9 Use dial indicators for measuring slack and run outs | | | | |
| E | Maintain AC and DC Motors | E-1 Use a tachometer to check speed | E-2 Understand differences between series, shunt & compound connected DC motors | E-3 Inspect motors for signs of damage and wear (armature, fixed field, AC variable speed) | E-4 Inspect brushes and replace if necessary | E-5 Troubleshoot motors using name plate data | E-6 Disconnect and reconnect motors to the power source | E-7 Identify frame type | E-8 Repair and maintain motor controls | | | | | |
| F | Maintain Single Phase Motors | F-1 Use a tachometer to check speed | F-2 Understand split phase induction motors | F-3 Understand capacitor start induction motors | F-4 Understand capacitor run induction motors | F-5 Understand shaded pole induction motors | F-6 Understand squirrel cage induction motors | F-7 Understand wound rotor induction motors | F-8 Understand synchronous motor operation | F-9 Inspect motor for signs of damage and wear | F-10 Troubleshoot motors using name plate data | F-11 Disconnect and reconnect motors | F-12 Identify frame and type | F-13 Repair and maintain motor controls |
| G | Maintain Three Phase Motors | G-1 Recognize the Wye and Delta configurations | G-2 Troubleshoot motors using name plate data | G-3 Connect and disconnect motors, including dual voltage nine lead machines | G-4 Identify frame type | G-5 Repair and maintain variable speed drives | G-6 Repair and maintain motor controls | | | | | | | |
| H | Read Basic Blueprints, Drawings and Schematics | H-1 Read circuit diagram schematics | H-2 Read wiring diagrams, including single line diagrams | H-3 Read ladder logic diagrams | H-4 Read digital logic diagrams | | | | | | | | | |
| I | Use Basic Electrical Metering Equipment | I-1 Use digital and analog ammeters | I-2 Use clamp on ammeters and apply proper shunt to read DC amperes | I-3 Use digital and analog voltmeters and wattmeters | I-4 Use meggers and insulation testers | I-5 Calibrate and repair electronic scales, loadcells | I-6 Use variable power supplies | I-7 Use signal generators and induce signals for diagnosis | | | | | | |
| J | Test Common Parts and Replace If Necessary | J-1 Test and replace single and three phase contactors | J-2 Test and replace motor starters | J-3 Test and replace overload devices | J-4 Test and replace relays and timers | J-5 Test and replace limit switches, i.e., SPST/SPDT/ DPST/DPDT | J-6 Test and replace switches, i.e., micro, pushbutton, cam, rotary, selector, multi-tier | J-7 Test and replace level and flow switches | J-8 Test and replace capacitors, coils and control transformers | J-9 Test and replace starting resistors, wire runs, lights, and switch gear | J-10 Test and replace fuses, circuit breakers and disconnects | J-11 Test and replace diodes, transistors and SCRs | J-12 Test and replace measuring instruments, i.e., varmeters and wattmeters | J-13 Test and replace volt-meters and ammeters |

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Maintain Transformers** | K-1 Understand basic transformer operation | K-2 Measure transformer voltages and currents | K-3 Test and change transformer oil | K-4 Replace/repair transformer coils and taps | K-5 Disconnect and connect transformers from the line | K-6 Troubleshoot transformers | | | | | | | |
| **Troubleshoot PLCs** | L-1 Understand PLC status indicators | L-2 Use PLCs to test input contacts and sensors | L-3 Read PLC line inputs and output conditions | L-4 Read PLC timer and counter information | L-5 Test input and output modules and replace if necessary | L-6 Understand Allen Bradley protocols and logic | | | | | | | |
| **Test/Repair Communication Systems** | M-1 Test/repair various types of microphones, amplifiers/speakers | M-2 Maintain RF devices | M-3 Install fiber optic cable | M-4 Install twisted pair cable | M-5 Install coaxial cable | M-6 Maintain video monitor equipment | | | | | | | |
| **Understand Basic Troubleshooting Techniques** | N-1 Follow power source to final device operation | N-2 Use ohmmeter for continuity checks | N-3 Check voltage/current levels against specifications | N-4 Check wiring against diagram | N-5 Analyze possible causes of problem using schematic diagram | N-6 Use isolation to identify problem area | N-7 Troubleshoot reliance drives and Fanuc controls | N-8 Troubleshoot operational faults with shop machines | N-9 Understand basic operations codes for machine operations | N-10 Use digital logic to replace RAM and E-prong | | | |
| **Use Computer** | O-1 Calibrate metal sensors | O-2 Operate power system via PC | O-3 Print out data report | O-4 Input data | O-5 Make inquiry via PC | O-6 Search/clear alarms | O-7 Use E-mail | | | | | | |

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## SKILLS AND KNOWLEDGE

- Communication Skills
- Use Measurement Tools
- Use Inspection Devices
- Mathematical Skills
- Reading/Writing Skills
- Knowledge of Safety Regulations
- Practice Safety in the Workplace
- Organizational Skills
- Knowledge of Company Policies/Procedures
- Mechanical Aptitude
- Ability to Comprehend Written/Verbal Instructions
- Knowledge of Cutting Fluids/Lubricants
- Basic Knowledge of Fasteners
- Ability to Work as Part of a Team
- Converse in the Technical Language of the Trade
- Knowledge of Occupational Opportunities
- Knowledge of Employee/Employer Responsibilities
- Knowledge of Company Quality Assurance Activities
- Practice Quality-Consciousness in Performance of the Job

## TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

DR. HUGH K. ROGERS
Director

DR. JON BOTSFORD
Assistant Director

JOE PENICK
Project Coordinator

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

**Furnished By:**

**MARTY SCHMIDT**
Senior Manufacturing Engineer
and Systems Design Engineer

**MICHAEL KON**
Manufacturing Engineer and
CNC Systems/Program Engineer

Texas State
Technical College
Waco

## TRAITS AND ATTITUDES

- Strong Work Ethic
- Interpersonal Skills
- Punctuality
- Dependability
- Honesty
- Neatness
- Safety Conscientious
- Motivation
- Responsible
- Physical Ability
- Professional
- Trustworthy
- Customer Relations
- Personal Ethics

## TOOLS AND EQUIPMENT

- Electrician's Tools (lineman pliers, wire strippers, screwdrivers, etc.)
- Electric Drills and Saws
- Conduit Threading Equipment
- Measuring Tools
- Volt-Ohm-Meters
- Tachometers
- Amp Meters (Clamp On)
- Power Supplies
- Oscilloscopes
- Signal Generators
- Power Distribution Center
- Computers
- Basic Drafting Tools
- Electrical Lighting Equipment
- Electrical Switches
- Electro-Mechanical Devices (Control Relays, Timers, Contactors, Motor Starters, etc.)
- Manual and Hydraulic Conduit Benders
- Electrical Panelboards
- Hazardous Location Equipment
- Wire Pulling Equipment
- AC Motors
- DC Motors
- Servo Motors
- Alternators and Generators
- Motor/Generator Logic Controllers
- Transits
- Transformers
- Transformer Test Sets
- Motor Control Center
- Motor Control Troubleshooting Trainers
- Switchgear
- Protective Metering and Relaying Test Equipment
- AC Drives
- DC Drives
- Servo Drives

## FUTURE TRENDS AND CONCERNS

- Advanced Computer Applications
- Fiber Optic Controls
- Advanced Test Equipment
- Robotics
- Advanced Metering Control

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## COMPETENCY PROFILE

# Electrical Systems Technician

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

LOCKHEED MARTIN

**ELECTRICAL SYSTEMS TECHNICIAN....uses knowledge and skills to install, maintain, and troubleshoot electrical/electronic equipment in residential, commercial, and industrial environments.**

| Duties | | ← Tasks → | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Electrical Safety | A-1 Keep one hand free when possible | A-2 Wear designated safety equipment | A-3 Use tag, lock and try procedures | A-4 Maintain CPR certification | A-5 When possible, turn off power when testing devices | A-6 Keep metal tools from high voltage areas | A-7 Work with a partner on high voltage jobs | A-8 Practice ladder safety | A-9 Use full protection equipment as requested | | | | |
| B | Perform Basic Mathematical Skills | B-1 Add, subtract, multiply and divide numbers | B-2 Calculate perimeters, areas and volumes | B-3 Use measurement conversion tables | B-4 Solve basic algebraic equations | | | | | | | | | |
| C | Perform Basic Electrical Functions | C-1 Measure/ calculate DC resistance, current and voltages | C-2 Measure/ calculate power in DC circuits | C-3 Read wire tables and find amperage/ resistance | C-4 Measure/ calculate AC currents, voltages and impedance | C-5 Measure power factor in AC circuits | | | | | | | | |
| D | Use Basic Hand and Power Tools | D-1 Measure with inch and metric rulers | D-2 Use screwdrivers, regular and ball peen hammers | D-3 Use crescent wrench, socket drives, lineman pliers | D-4 Use hacksaws, wire stripper, try square, nut driver | D-5 Use tie wrap gun, hex wrenches, channel lock pliers | D-6 Use diagonal cutting pliers, sheet metal snips | D-7 Use hole cutters | D-8 Use drills and reamers | | | | | |
| E | Maintain DC Motors | E-1 Use a tachometer to check speed | E-2 Understand differences between series, shunt & compound connected DC motors | E-3 Inspect motor for signs of damage and wear | E-4 Inspect brushes and replace if necessary | E-5 Troubleshoot motors using name plate data | E-6 Disconnect and reconnect motors to the power source | E-7 Identify frame type | E-8 Repair and maintain motor controls | | | | | |
| F | Maintain Single Phase Motors | F-1 Use a tachometer to check speed | F-2 Understand types of induction motors, i.e., split phase | F-3 Understand types of induction motors, i.e., capacitor start | F-4 Understand types of induction motors, i.e., capacitor run | F-5 Understand types of induction motors, i.e., shaded pole | F-6 Understand types of induction motors, i.e., squirrel cage | F-7 Understand types of induction motors, i.e., wound rotor | F-8 Understand synchronous motor operation | F-9 Inspect motor for signs of damage and wear | F-10 Troubleshoot motors using name plate data | F-11 Disconnect and reconnect motors | F-12 Identify frame and type | F-13 Repair and maintain motor controls |
| G | Maintain Three Phase Motors | G-1 Recognize the Wye and Delta configurations | G-2 Troubleshoot motors using name plate data | G-3 Connect and disconnect motors, including dual voltage nine lead machines | G-4 Identify frame type | G-5 Repair and maintain variable speed drives | G-6 Repair and maintain motor controls | | | | | | | |
| H | Read Basic Blueprints, Drawings and Schematics | H-1 Read circuit diagram schematics | H-2 Read wiring diagrams, including single line diagrams | H-3 Read ladder logic diagrams | H-4 Read digital logic diagrams | | | | | | | | | |
| I | Use Basic Electrical Metering Equipment | I-1 Use digital and analog ammeters | I-2 Use clamp-on ammeters | I-3 Use digital and analog voltmeters or read wattmeters | I-4 Use meggers and insulation testers | I-5 Calibrate and repair electronic scales, loadcells | I-6 Use variable power supplies | | | | | | | |
| J | Test Common Parts and Replace If Necessary | J-1 Test and replace single and three phase contactors | J-2 Test and replace motor starters | J-3 Test and replace overload devices | J-4 Test and replace relays and timers | J-5 Test and replace switches, i.e., SPST/ SPDT/DPST/ DPDT limit | J-6 Test and replace switches, i.e., micro, pushbutton, cam, and rotary | J-7 Test and replace switches, i.e., level and flow switches | J-8 Test and replace capacitors, coils, control transformers | J-9 Test and replace starting resistors, wire runs, lights, and switch gear | J-10 Test and replace fuses, circuit breakers and disconnects | J-11 Test and replace diodes, transistors, SCRs | J-12 Test and replace measuring instruments, i.e., varmeters, wattmeters | J-13 Test and replace voltmeters, ammeters |

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| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** | **Maintain Transformers** | K-1 Understand basic transformer operation | K-2 Measure transformer voltages and currents | K-3 Test and change transformer oils | K-4 Replace/repair transformer coils and taps | K-5 Disconnect and connect transformers from the line | | | | | | | | |
| **L** | **Troubleshoot PLCs** | L-1 Understand PLC status indicators | L-2 Use PLCs to test input contacts and sensors | L-3 Read PLC line inputs and output conditions | L-4 Read PLC timer, counter information | L-5 Test input and output modules and replace if necessary | | | | | | | | |
| **M** | **Test/Repair Communication Systems** | M-1 Test/repair various types of microphones, amplifiers/speakers | M-2 Maintain RF devices | M-3 Install fiber optic cable | M-4 Install twisted pair cable | M-5 Install co-axial cable | M-6 Maintain video monitor equipment | | | | | | | |
| **N** | **Understand Basic Troubleshooting Techniques** | N-1 Follow power source to final device operation | N-2 Use ohmmeter for continuity checks | N-3 Check voltage/current levels against specification | N-4 Check wiring against diagram | N-5 Analyze possible causes of problem using schematic diagram | N-6 Use isolation to identify problem area | | | | | | | |
| **O** | **Use Computer** | O-1 Calibrate metal sensors | O-2 Operate power system via P.C. | O-3 Print out data report | O-4 Input data | O-5 Make inquiry via P.C. | O-6 Search/clear alarms | O-7 Use E-mail | | | | | | |

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Knowledge of Cutting Fluids/Lubricants
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

## TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

DR. HUGH ROGERS
Director

DR. JON BOTSFORD
Assistant Director

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

## REED TOOL COMPANY REPRESENTATIVE

T. J. BUROE, JR.
Electrical Supervisor/Maintenance Manager

RUSTY WALSTON
Lead Technician

Texas State
Technical College
Waco

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Electrician's Tools (lineman pliers, wire strippers, screwdrivers, etc.)
Electric Drills and Saws
Conduit Threading Equipment
Measuring Tools
Volt-Ohm-Meters
Tachometers
Amp Meters (Clamp On)
Power Supplies
Oscilloscopes
Signal Generators
Power Distribution Center
Computers
Basic Drafting Tools
Electrical Lighting Equipment
Electrical Switches
Electro-Mechanical Devices (Control Relays, Timers, Contactors, Motor Starters, etc.)
Manual and Hydraulic Conduit Benders
Electrical Panelboards
Hazardous Location Equipment
Wire Pulling Equipment
AC Motors
DC Motors
Servo Motors
Alternators and Generators
Motor/Generator Logic Controllers
Transits
Transformers
Transformer Test Sets
Motor Control Center
Motor Control Troubleshooting Trainers
Switchgear
Protective Metering and Relaying Test Equipment
AC Drives
DC Drives
Servo Drives

## FUTURE TRENDS AND CONCERNS

Advanced Computer Applications
Fiber Optic Controls
Advanced Test Equipment
Robotics
Advanced Metering Control

# COMPETENCY PROFILE
# Electrical Systems Technician

**Conducted By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

REED
TOOL COMPANY
A SUBSIDIARY OF CAMCO

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## ELECTRICAL SYSTEMS TECHNICIAN....uses knowledge and skills to install, maintain, and troubleshoot electrical/electronic equipment in residential, commercial, and industrial environments.

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Electrical Safety | A-1 Keep one hand free when possible | A-2 Wear designated safety equipment | A-3 Use tag, lock and try procedures | A-4 Maintain CPR certification | A-5 When possible, turn off power when testing devices | A-6 Keep metal tools from high voltage areas | A-7 Work with a partner on high voltage jobs | A-8 Practice ladder safety | A-9 Use full protection equipment as requested | | | | |
| B | Perform Basic Mathematical Skills | B-1 Perform basic arithmetic functions | B-2 Calculate perimeters, areas and volumes | B-3 Use measurement conversion tables | B-4 Solve basic algebraic equations | B-5 Solve basic Boolian algebra problems | B-6 Solve digital math problems | B-7 Perform light calculus problems | | | | | | |
| C | Perform Basic Electrical Functions | C-1 Measure/calculate DC resistance, current and voltages | C-2 Measure/calculate power in DC circuits | C-3 Read wire tables and find amperage/resistance | C-4 Measure/calculate AC currents, voltages and impedance | C-5 Understand and use NEC for installation and repair | | | | | | | | |
| D | Use Basic Hand and Power Tools | D-1 Measure with inch and metric rulers | D-2 Use screwdrivers, regular and ball peen hammers | D-3 Use crescent wrench, socket drives and lineman pliers | D-4 Use hacksaws, wire stripper, try square, and nut driver | D-5 Use tie wrap gun, hex wrenches and channel lock pliers | D-6 Use diagonal cutting pliers and sheet metal snips | D-7 Use hole cutters | D-8 Use drills and reamers | | | | | |
| E | Maintain DC Motors | E-1 Use a tachometer to check speed | E-2 Understand differences between series, shunt & compound connected DC motors | E-3 Inspect motor for signs of damage and wear | E-4 Inspect brushes and replace if necessary | E-5 Troubleshoot motors using name plate data | E-6 Disconnect and reconnect motors to the power source | E-7 Identify frame type | E-8 Repair and maintain motor controls | E-9 Diagnose faults with DC variable speed motors | E-10 Understand and diagnose faults with positional and positional velocity controls | | | |
| F | Maintain Single Phase AC Motors | F-1 Use a tachometer to check speed | F-2 Understand split phase induction motors | F-3 Understand capacitor start induction motors | F-4 Understand capacitor run induction motors | F-5 Understand shaded pole induction motors | F-6 Understand squirrel cage induction motors | F-7 Understand wound rotor induction motors | F-8 Understand synchronous motor operation | F-9 Inspect motor for signs of damage and wear | F-10 Troubleshoot motors using name plate data | F-11 Disconnect and reconnect motors | F-12 Identify frame and type | F-13 Repair and maintain motor controls |
| G | Maintain Three Phase AC Motors | G-1 Recognize the Wye and Delta configurations | G-2 Troubleshoot motors using name plate data | G-3 Connect and disconnect motors, including dual voltage nine lead machines | G-4 Identify frame type | G-5 Repair and maintain variable speed drives | G-6 Repair and maintain motor controls | | | | | | | |
| H | Read Basic Blueprints, Drawings and Schematics | H-1 Read circuit diagram schematics | H-2 Read wiring diagrams, including single line diagrams | H-3 Read ladder logic diagrams | H-4 Read digital logic diagrams | | | | | | | | | |
| I | Use Basic Electrical Metering Equipment | I-1 Use digital and analog ammeters | I-2 Use clamp-on ammeters | I-3 Use digital and analog voltmeters and wattmeters | I-4 Use meggers and insulation testers | I-5 Calibrate and repair electronic scales, loadcells | I-6 Use variable power supplies | I-7 Use digital and analog oscilloscopes | I-8 Troubleshoot all electrical/electronic equipment to board level | | | | | |
| J | Test Common Parts and Replace If Necessary | J-1 Test and replace single and three phase contactors | J-2 Test and replace motor starters | J-3 Test and replace overload devices | J-4 Test and replace relays and timers | J-5 Test and replace limit switches, i.e., SPST/SPDT/DPST/DPDT | J-6 Test and replace switches, i.e., micro, pushbutton, cam, and rotary | J-7 Test and replace switches, i.e., level and flow | J-8 Test and replace capacitors, coils and control transformers | J-9 Test and replace starting resistors, wire runs, lights, and switch gear | J-10 Test and replace fuses, circuit breakers and disconnects | J-11 Test and replace diodes, transistors and SCRs | J-12 Test and replace measuring instruments, i.e., varmeters and wattmeters | J-13 Test and replace voltmeters and ammeters |

RESDEST FM3
MAST 051995

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** | **Maintain Transformers** | K-1 Understand basic transformer operation | K-2 Measure transformer voltages and currents | K-3 Replace/ repair transformer coils and taps | K-4 Disconnect and connect transformers from the line | | | | | | | | | |
| **L** | **Troubleshoot PLCs and Control Systems** | L-1 Understand PLC status indicators | L-2 Understand ladder logic and digital programming | L-3 Use computer software to interrogate PLCs | L-4 Use PLCs to test input contacts and sensors | L-5 Read PLC line inputs and output conditions | L-6 Read PLC timer and counter information | L-7 Test input and output modules and replace if necessary | L-8 Troubleshoot multi-processing equipment | L-9 Troubleshoot numerical controls | L-10 Understand and apply basic numerical control programming required to test equipment | L-11 Understand encoders, resolvers, positional indexing equipment, velocity loops, & linear measurement devices | | |
| **M** | **Test/Repair Communication Systems** | M-1 Install fiber optic cable | M-2 Install twisted pair cable | M-3 Install co-axial cable | M-4 Understand and use interface devices (RS-232 and RS-422A) | M-5 Use PROCOMM diagnostic software for systems test | M-6 Maintain video monitor equipment | | | | | | | |
| **N** | **Understand Basic Troubleshooting Techniques** | N-1 Follow power source to final device operation | N-2 Use ohmmeter for continuity checks | N-3 Check voltage/current levels against specifications | N-4 Check wiring against diagram | N-5 Analyze possible causes of problem using schematic diagram | N-6 Use isolation to identify problem area | N-7 Test all types of switches and switch components | N-8 Understand and use Boolian logic needed for troubleshooting | N-9 Understand logic gates | | | | |
| **O** | **Use Computer** | O-1 Calibrate metal sensors | O-2 Operate power system via PC | O-3 Use DOS and Windows | O-4 Print out data report | O-5 Input data | O-6 Make inquiry via PC | O-7 Search/ clear alarms | O-8 Use computer to interrogate control systems | O-9 Use E-mail | | | | |

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Knowledge of Cutting Fluids/Lubricants
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

## TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

DR. HUGH ROGERS
Director

DR. JON BOTSFORD
Assistant Director

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

## ALCOA REPRESENTATIVES

MICHAEL L. VIDRINE, P.E.
Central Engineering & Maintenance Service Superintendent

TOM JANUARY
General Mechanic

Texas State
Technical College
Waco

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Mechanic's Tools (e.g., toolbox, wrenches
sockets, hammers, etc.)
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

## FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

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# COMPETENCY PROFILE
# General Mechanic

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

ALCOA

BEST COPY AVAILABLE

## GENERAL MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Perform Basic Mathematical Skills | A-1 Add, subtract, multiply and divide numbers | A-2 Calculate perimeters, areas and volumes | A-3 Use measurement conversion tables | A-4 Solve basic algebraic equations | | | | | | | | | |
| B | Use Basic Hand and Power Tools | B-1 Read rulers in inches or metric | B-2 Use drills, impacts, hammers, screw drivers, end wrenches | B-3 Use socket drives, pliers, hack saws, pipe wrenches | B-4 Use adjustable wrenches and pliers, allen wrenches | B-5 Use torque wrenches, grinders, sanders | B-6 Use pipe cutting and threading machines | B-7 Use hand held pipe threading tools, taps and dies | B-7 Use squares, levels, files, brushes, plumb bob, chisels | B-8 Use punches, band saws, chop saws, micrometer | B-9 Use dial indicator, dial caliper, feeler gauges, etc. | | | |
| C | Read Blueprints and Schematics | C-1 Interpret hydraulic and pneumatic schematics | C-2 Interpret piping blueprints | C-3 Interpret combustion gas systems schematics | C-4 Interpret structural blueprints | C-5 Interpret weld symbols | C-6 Interpret steam system blueprints | C-7 Troubleshoot electrical schematics for hydraulic systems | C-8 Draw an isometric sketch | | | | | |
| D | Practice Safety | D-1 Recognize and comprehend safety literature | D-2 Recognize and comprehend safety signs and emblems | D-3 Recognize and comprehend safety tags and lockouts | D-4 Be aware of special safety procedures in various work areas | D-5 Use ALCOA issue safety equipment properly | D-6 Use self contained breathing apparatus correctly | D-7 Know Chlorine Safety Hazards | | | | | | |
| E | Perform Pipe Fitter Skills | E-1 Calculate, layout and cut pipe to proper lengths | E-2 Calculate, layout and cut pipe to proper angle for joint/fitting makeup | E-3 Calculate, cut and thread pipe to proper lengths | E-4 Calculate, layout & bend copper tubing for flare & compression fittings | E-5 Calculate, layout & bend aluminum tubing for flare & compression fittings | E-6 Calculate, layout & bend stainless steel tubing for flare & compression fittings | E-7 Calculate, layout & cut aluminum tubing for braze/solder fittings | E-8 Solder and/or braze aluminum tubing | E-9 Calculate, layout & cut copper tubing for braze/solder fittings | E-10 Solder and/or braze copper tubing | E-11 Calculate, layout & cut stainless steel tubing for braze/solder fittings | E-12 Solder and/or braze stainless steel tubing | E-13 Calculate, layout, cut & cement PVC pipe to proper lengths |
| | | E-14 Calculate, layout, cut & cement D-W-V pipe to proper lengths | E-15 Adjust and/or repair/replace valves | E-16 Adjust and/or repair/replace regulators and sight glasses | E-17 Inspect and/or clean/replace filters/strainers | E-18 Maintain and/or repair/replace steam system boiler components | E-19 Inspect, repair/replace Bailey valves | E-20 Maintain and/or repair/replace steam traps | E-21 Inspect and/or replace heat exchanger tubes | E-22 Maintain/replace chlorine regulators and valves | E-23 Adjust and/or repair/replace other chlorine system components | E-24 Discuss safety hazzards involved with the Leachate System (Cyanide & Arsenic) | E-25 Discuss safety hazards involved with potable & waste water | E-26 Maintain a/c systems for overhead cranes |
| | | E-27 Maintain a/c systems for pot diggers | E-28 Maintain a/c systems for cab type pieces of equipment | E-29 Maintain commercial water and air cooled condenser a/c systems | E-30 Maintain cooling tower systems | | | | | | | | | |
| F | Troubleshoot Hydraulic and Pneumatic Devices | F-1 Know nomenclature of systems | F-2 Troubleshoot systems | F-3 Adjust, repair/replace valves | F-4 Adjust, repair/replace cylinders | F-5 Adjust, repair/replace actuators | F-6 Inspect, repair/replace pumps | F-7 Inspect, repair/replace fans, blowers | F-8 Inspect, repair/replace motors | F-9 Inspect, repair/replace compressors | F-10 Inspect and/or clean/replace filters/strainers | F-11 Adjust, repair/replace regulators | F-12 Check fluid levels and/or replenish | F-13 Inspect and/or replace hoses |
| | | F-14 Check and solve system leakages | F-15 Substitute Viton O-rings in Phosphate Ester systems | F-16 Maintain Phosphate Ester systems to proper temperature | F-17 Service water strainers for prevention of overheating of hydraulic systems | F-18 Maintain correct air pressure & air flow thru Dense Phase Unit systems | | | | | | | | |
| G | Perform Rigging Operations | G-1 Perform hand signals correctly | G-2 Determine proper line parts, sheave size, and cable size per load | G-3 Use wire rope, nylon rope, chains in proper manner | G-4 Select proper slings in single & multiple leg use for various load lifts | G-5 Select and use proper size shackles per load | G-6 Select and use proper size cable clamps correctly | G-7 Check for minimum number of cable wraps on cable drum | G-8 Inspect/replace wire rope cable as needed | | | | | |

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H | Operate Mobile Crane, Forklift, & Man-lift | H-1 Perform safety checks | H-2 Recognize proper hand signals | H-3 Recognize maximum load capacities | H-4 Use outriggers correctly | H-5 Recognize equipment's center of gravity | H-6 Know equipment's controls | H-7 Operate equipment safely | | | | | | |
| I | Repair Window Air Conditioners | I-1 Perform troubleshooting techniques | I-2 Properly use a volt/amp meter | I-3 Check and/ or charge with freon | I-4 Inspect and/ or clean/replace filters | I-5 Inspect and/ or replace fan or fan motor | I-6 Inspect and/ or replace thermostat switch | I-7 Maintain certification for freon recovery | | | | | | |
| J | Repair Mechanical Devices | J-1 Perform equipment installation | J-2 Perform unbolting and torquing to bolt grade specs. | J-3 Perform lubrication skills per equipment's needs | J-4 Replace bearings, seals, and packing | J-5 Replace sprockets, gears, rollers, pulleys, sheaves | J-6 Replace belts and chains | J-7 Replace fans, and vanes | J-8 Install shims and spacers | J-9 Install shafts, pins and keys | J-10 Identify, install and maintain couplings | J-11 Perform drilling, tapping, and threading operations | J-12 Align equipment by single, double, and reverse dial indicator methods | J-13 Perform vibration analysis and balancing |
| | | J-14 Perform optical alignment | J-15 Perform optical comparator setting & alignment on components | J-16 Properly adjust belts and chains | J-17 Align sprockets, gears and sheaves | J-18 Measure, cut and splice conveyor belts | J-19 Remove and install buckets on conveyors | J-20 Remove and install screw conveyor flights and hangers | J-21 Remove and install chain sections on chain conveyors | J-22 Maintain speed reducers and increasers | J-23 Maintain plant air compressors & systems components | J-24 Maintain power transmission clutches | J-25 Maintain power transmission brakes | J-26 Maintain hydraulic, electrical, & magnetic brakes on overhead cranes |
| K | Perform Welding Skills | K-1 Practice safety with oxyacetylene equipment | K-2 Perform oxyacetylene welding and brazing | K-3 Perform oxyacetylene brazing and soldering | K-4 Perform oxyacetylene cutting and gouging/ washing | K-5 Perform oxyacetylene cutting with tractor type torch equipment | K-6 Perform oxyacetylene cutting with pipe cutting torch equipment | K-7 Discuss Shielded Metal Arc Welding (SMAW) terminology | K-8 Discuss Gas Metal Arc Welding (GMAW) terminology | K-9 Discuss Flux Cored Arc Welding (FACW) terminology | K-10 Discuss Gas Tungsten Arc Welding (GTAW) terminology | K-11 Discuss Air Carbon Arc Cutting (AAC) terminology | K-12 Discuss Plasma Arc Cutting (PAC)terminology | K-13 Use the AWS electrode and filler metal classification system for all processes |
| | | K-14 Perform SMAW on stainless steel and steel plate and pipe | K-15 Perform SMAW on cast iron with nickel electrodes | K-16 Perform SMAW on steel with hardfacing electrodes | K-17 Perform GMAW on steel plate & pipe | K-18 Perform GMAW on aluminum materials | K-19 Perform GMAW on stainless steel & copper plate | K-20 Perform FCAW steel plate materials in all positions | K-21 Perform FCAW build up with hardfacing electrodes | K-22 Perform AAC cutting/ gouging of all metals | K-23 Perform PAC of steel, stainless, aluminum, nickel & copper | K-24 Perform GTAW on steel, stainless & inconel materials | K-25 Perform GTAW on aluminum plate materials | K-26 Calculate, layout, cut, fit & weld various structural & piping members |
| | | K-27 Use oxyacetylene to heat, bend, form & straighten various structural & piping members | | | | | | | | | | | | |
| L | Maintain Combustion Systems | L-1 Troubleshoot systems in an efficient manner | L-2 Know proper gas flame size and color | L-3 Properly adjust gas & air mixture ratios on furnaces, filter boxes | L-4 Properly adjust gas & air mixture ratios on alumina and cruce heaters | L-5 Adjust and/ or repair/ replace burners | L-6 Adjust and/ or repair/ replace regulators | L-7 Adjust and/ or repair/replace pressure switches | L-8 Adjust spark | L-9 Adjust and/ or repair/replace controllers | L-10 Adjust and/or repair/ replace control valves and actuators | L-11 Adjust and/or repair/ replace limiting orifice valves and orifices | L-12 Adjust and/or repair/ replace air damper | L-13 Adjust and/or repair/ replace blower |
| | | L-14 Adjust and/or repair/ replace latch valve | L-15 Adjust and/or repair/ replace pilot system | L-16 Check and/ or replace thermocouples | L-17 Check for and solve air and gas leak problems | L-18 Adjust all combustion controls when changing from natural gas to propane | L-19 Discuss the safety precautions that must be followed when using propane | | | | | | | |
| M | Use Computer | M-1 Use maintenance programs | M-2 Program ladder logic for PLCs | M-3 Print reports | M-4 Enter/input data | M-5 Use Lotus 1-2-3 or Quattro Pro | M-6 Use Word Perfect | M-7 Work in a Windows environment | M-8 Use AUTOCAD | M-9 Use E-Mail | | | | |

### SKILLS AND KNOWLEDGE
Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

### AUGUSTA TECHNICAL INSTITUTE MAST PROGRAM REPRESENTATIVES

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THOMAS SANCHEZ
Instructor - Industrial Maintenance Technology

MARSHA HARRISON
Accounts Manager

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DEBRA MACAFEE
Maintenance Supervisor

DR. TWYLA TUTEN
Training Consultant

FIVE UNNAMED MAINTENANCE MECHANICS

AMTEC

### TRAITS AND ATTITUDES
Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

### TOOLS AND EQUIPMENT
Mechanic's Tools (e.g., toolbox, wrenches,
sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

### FUTURE TRENDS AND CONCERNS
Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

# COMPETENCY PROFILE

# INDUSTRIAL MAINTENANCE MECHANIC

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

AMTEC

## AUGUSTA TECHNICAL INSTITUTE

AMOCO

**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | Practice Safety | A-1 Recognize OSHA requirements | A-2 Demonstrate use of personal protective equipment | | | | | | | | | | | |
| **B** | Apply Mathematical Concepts | B-1 Perform basic arithmetic functions | B-2 Convert fractions/ decimals | B-3 Convert Metric/English measurements | B-4 Perform basic algebraic operations | B-5 Perform basic trigonometric functions | B-6 Perform basic geometric calculations | | | | | | | |
| **C** | Interpret Engineering Drawings and Control Documents | C-1 Review blueprint notes and dimensions | C-2 Identify basic layout of drawings | C-3 Identify basic types of drawings | | | | | | | | | | |
| **D** | Use Measuring Tools | D-1 Use non precision measuring tools | D-2 Use precision measuring tools | D-5 Use Metric and English standards of measurement | | | | | | | | | | |
| **E** | Use Hand Tools | E-1 Identify and use maintenance technicians hand tools | E-2 Identify and use hand held power tools | | | | | | | | | | | |
| **F** | Operate Machine Tools | F-1 Use & care pressure tools | F-2 Use & care horiz. & vertical band saws | F-3 Use & care of pedestal grinder | F-4 Use & care of surface grinder | F-5 Use & care of lathes | F-6 Use & care of radial arm drill press | | | | | | | |
| **G** | Perform Welding Operations | G-1 Weld with Shielded Metal Arc Welding (SMAW) process | G-2 Weld/cut with oxyacetylene | G-3 Perform gas soldering | | | | | | | | | | |
| **H** | Maintain & Troubleshoot Equipment and Systems | H-1 Maintain air conditioning systems | H-2 Maintain pneumatic control circuits | H-3 Trouble-shoot centrifugal pumps | H-4 Trouble-shoot positive displacement pumps | H-5 Maintain gate, globe, ball, plug and butterfly valves | H-6 Maintain check valves and relief valves | H-7 Trouble shoot and repair blowers | H-8 Trouble shoot, maintain, and repair hydraulic systems | | | | | |
| **I** | Repair Power Transmission Systems | I-1 Maintain & Trouble-shoot belt drive systems | I-2 Maintain & Trouble-shoot gear power transmission drives | I-3 Maintain & Trouble-shoot chain power transmission drives | | | | | | | | | | |
| **J** | | | | | | | | | | | | | | |

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Piping Operations | K-1 Perform basic pipefitting calculations | K-2 Cut, thread and ream pipe | K-3 Assemble pipe with threaded flanges | K-4 Install & adjust pipe support | K-5 Flare pipe | K-6 Bend metal tubing | K-7 Join plastic pipe | | | | | | |
| L | Basic Rigging | L-1 Rigging Fundamentals | L-2 Demonstrate basic rigging skills | | | | | | | | | | | |
| M | Operate Hoisting Equipment | M-1 Move a load using a hoist | | | | | | | | | | | | |
| N | Bearing Maintenance | N-1 Remove/ install a journal bearing | N-2 Remove/ install an anti friction bearing | N-3 Install/ remove a thrust bearing | N-4 Identify causes of bearing failures | N-5 Gather vibration analysis data | | | | | | | | |
| O | Use Computers | O-1 Perform basic word processing | O-2 Perform basic spread sheet operations | | | | | | | | | | | |
| P | Align Shafts | P-1 Perform alignment using single and reverse indicator methods | | | | | | | | | | | | |
| Q | Install/ Align Machines | Q-1 Install electrical connections | Q-2 Perform required pipe fitting tasks | Q-3 Grout as necessary | Q-4 Discuss mounting methods | Q-5 Level and align machine components | Q-6 Use stud gun | Q-7 Perform electrical and pneumatic drilling operations | | | | | | |
| R | Maintain Electrical Devices | R-1 Use electrical test equipment | R-2 Apply specific terms to electrical circuits | R-3 Analyze series, parallel and complex DC/AC circuits | R-4 Check AC and DC motors | R-5 Trouble-shoot electrical devices | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

## SKILLS AND KNOWLEDGE

- Communication Skills
- Use Measurement Tools
- Use Inspection Devices
- Mathematical Skills
- Reading/Writing Skills
- Knowledge of Safety Regulations
- Practice Safety in the Workplace
- Organizational Skills
- Knowledge of Company Policies/Procedures
- Mechanical Aptitude
- Ability to Comprehend Written/Verbal Instructions
- Basic Knowledge of Fasteners
- Ability to Work as Part of a Team
- Converse in the Technical Language of the Trade
- Knowledge of Occupational Opportunities
- Knowledge of Employee/Employer Responsibilities
- Knowledge of Company Quality Assurance Activities
- Practice Quality-Consciousness in Performance of the Job

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Instructor - Industrial Maintenance Technology

MARSHA HARRISON
Accounts Manager

## AUTOMATIC SWITCH COMPANY REPRESENTATIVES

JIM MULLIN
Facilities Manager

TONY GINN
Plant Management Facilitator

AMTEC

## TRAITS AND ATTITUDES

- Strong Work Ethic
- Interpersonal Skills
- Punctuality
- Dependability
- Honesty
- Neatness
- Safety Conscientious
- Motivation
- Responsible
- Physical Ability
- Professional
- Trustworthy
- Customer Relations
- Personal Ethics

## TOOLS AND EQUIPMENT

- Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
- Measuring Tools
- Power Tools
- Drill Presses
- Power Saws
- Power Drills
- Hydraulic/Arbor Press
- Welding Equipment (SMAW, GMAW, FCAW, Plasma)
- Alignment/Calibration Tools
- Computer
- Forklift
- Personal Safety Equipment
- Oxyacetylene Equipment
- Tool Storage Equipment
- Workbenches
- Vises
- Pedestal Grinders
- Pipe Threading Dies
- Pipe/Conduit Bending Equipment
- A/C Service Equipment
- Steam/Boiler System Equipment
- Power Transmission Devices
- Gasoline Power Plant
- Diesel Power Plant
- Hydraulic Training Equipment
- Electrical Testing Equipment
- Air Compressor
- Air Powered Tools
- Hydraulic Jack
- Chain Hoist

## FUTURE TRENDS AND CONCERNS

- Statistical Process Control
- Composites
- Laser Alignment
- Advanced Computer Applications
- Robotics
- Environmental Concerns
- Fiber Optic Controls
- Automated Material Handling Equipment
- More Sophisticated Computer Controls
- Hazardous Materials Handling

# COMPETENCY PROFILE

# INDUSTRIAL MAINTENANCE MECHANIC

Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)

AMTEC

AUGUSTA TECHNICAL INSTITUTE

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## INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Safety | A-1 Recognize OSHA requirements | A-2 Demonstrate use of personal protective equipment | | | | | | | | | | | |
| B | Apply Mathematical Concepts | B-1 Perform basic arithmetic functions | B-2 Convert fractions/ decimals | B-3 Convert Metric/English measurements | B-4 Perform basic algebraic operations | B-5 Perform basic trigonometric functions | B-6 Perform basic geometric calculations | | | | | | | |
| C | Interpret Engineering Drawings and Control Documents | C-1 Review blueprint notes and dimensions | C-2 Identify basic layout of drawings | C-3 Identify basic types of drawings | | | | | | | | | | |
| D | Use Measuring Tools | D-1 Use non precision measuring tools | D-2 Use precision measuring tools | D-3 Use Metric and English standards of measurement | | | | | | | | | | |
| E | Use Hand Tools | E-1 Identify and use maintenance technicians hand tools | E-2 Identify and use hand held power tools | | | | | | | | | | | |
| F | Operate Machine Tools | F-1 Operate lathe | F-2 Operate drill presses | F-3 Operate pedestal grinder | F-4 Operate surface grinder | F-5 Operate power saws | F-6 Operate hydraulic/ mechanical presses | | | | | | | |
| G | Perform Welding Operations | G-1 Weld with Shielded Metal Arc Welding (SMAW) process | G-2 Weld/cut with oxyacetylene | | | | | | | | | | | |
| H | Maintain & Troubleshoot Equipment and Systems | H-1 Maintain air conditioning systems | H-2 Maintain pneumatic control circuits | H-3 Trouble-shoot centrifugal pumps | H-4 Trouble-shoot positive displacement pumps | H-5 Maintain gate, globe, ball, plug and butterfly valves | H-6 Maintain check valves and relief valves | H-7 Trouble shoot and repair blowers | H-8 Trouble shoot, maintain, and repair hydraulic systems | | | | | |
| I | Repair Power Transmission Systems | I-1 Maintain & Trouble-shoot gear power transmission drives | I-2 Maintain & Trouble-shoot chain power transmission drives | I-3 Maintain & Trouble-shoot belt drive systems | | | | | | | | | | |
| J | Fabricate/ Install Sheet Metal Parts | J-1 Layout sheet metal parts | J-2 Form and/or bend sheet metal parts | J-3 Fasten sheet metal parts together | | | | | | | | | | |

|  | Duties | Tasks |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Piping Operations | K-1 Perform basic pipefitting calculations | K-2 Weld with shielded metal arc welding (SMAW) | K-3 Weld/Cut with oxyacetylene | K-4 Solder Metal Tubing |  |  |  |  |  |  |  |  |  |
| L | Basic Rigging | L-1 Rigging Fundamentals | L-2 Demonstrate basic rigging skills |  |  |  |  |  |  |  |  |  |  |  |
| M | Operate Hoisting Equipment | M-1 Move a load using a hoist |  |  |  |  |  |  |  |  |  |  |  |  |
| N | Bearing Maintenance | N-1 Remove/ install a journal bearing | N-2 Remove/ install an anti friction bearing | N-3 Install/ remove a thrust bearing |  |  |  |  |  |  |  |  |  |  |
| O | Use Computers | O-1 Perform basic word processing | O-2 Perform basic spread sheet operations |  |  |  |  |  |  |  |  |  |  |  |
| P | Align Shafts | P-1 Perform alignment using feeler gauges | P-2 Perform alignment using single and reverse indicator methods |  |  |  |  |  |  |  |  |  |  |  |
| Q | Install/ Align Machines | Q-1 Install electrical connections | Q-2 Perform required pipe fitting tasks | Q-3 Grout as necessary | Q-4 Discuss mounting methods | Q-5 Level and align machine components | Q-6 Discuss finishing materials (i.e., paints, sealers) | Q-7 Use stud gun | Q-8 Perform electrical and pneumatic drilling operations |  |  |  |  |  |
| R | Maintain Electrical Devices | R-1 Use electrical test equipment | R-2 Apply specific terms to electrical circuits | R-3 Analyze series, parallel and complex DC/AC circuits | R-4 Check AC and DC motors | R-5 Trouble-shoot electrical devices |  |  |  |  |  |  |  |  |
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## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Knowledge of Cutting Fluids/Lubricants
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job
Knowledge of Manufacturing Processes

## TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

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Texas State
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Waco

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist
Electric Pallet Jacks
Tow Motors

## FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

## COMPETENCY PROFILE

# Industrial Maintenance Mechanic

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

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**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| | Duties | ← Tasks → | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **Practice Safety** | A-1 Follow safety manuals and all safety regulations/requirements | A-2 Set up and use welding equipment | A-3 Wear personal safety equipment | A-4 Maintain a clean and safe work environment | | | | | | | | | |
| **B** | **Operate Machine Tools** | B-1 Operate lathes | B-2 Operate milling machines | B-3 Operate drill presses | B-4 Operate boring machines | B-5 Operate pedestal grinders | B-6 Operate surface grinders | B-7 Operate bandsaws | B-8 Operate shapers | B-9 Operate metal shears | B-10 Operate brakes | B-11 Operate cut off saws | B-12 Operate presses | B-13 Operate hoists and overhead cranes |
| **C** | **Use Precision Measuring Tools** | C-1 Measure with steel rules | C-2 Measure with micrometers (all types) | C-3 Measure with transfer type measuring instruments | C-4 Align work with dial indicators | C-5 Measure with dial calipers | C-6 Lay out with height gage | C-7 Use gage blocks | C-8 Use inch and metric system | | | | | |
| **D** | **Use Hand Tools** | D-1 Use files | D-2 Use taps | D-3 Use dies | D-4 Install helicoils | D-5 Use drill motors | D-6 Use impact and torque wrenches | D-7 Use hacksaws | D-8 Use gasket cutters | D-9 Install safety wire | D-10 Use wrenches of various types | D-11 Use vises | D-12 Make specialty tools | D-13 Use snap ring pliers and pullers |
| **E** | **Perform Various Production Processes** | E-1 Weld using SMAW process in different positions | E-2 Weld different types of joints using the SMAW process | E-3 Cut/weld using the oxyacetylene process in different positions | E-4 Cut/weld different types of joints with oxyacetylene | E-5 Weld with GTAW (heliarc) | E-6 Weld with GMAW (mig) | E-7 Perform Plasma Arc cutting | E-8 Fabricate machinery guards | E-9 Remove faulty components by heating or cutting | | | | |
| **F** | **Read/ Interpret Prints** | F-1 Interpret mechanical prints | F-2 Interpret electrical prints | F-3 Interpret pneumatic schematics | F-4 Interpret hydraulic schematics | F-5 Interpret welding prints | F-6 Interpret plumbing or piping prints | F-7 Interpret conveyor system prints | F-8 Understand bill of materials callouts | | | | | |
| **G** | **Troubleshoot Equipment and Systems** | G-1 Maintain air conditioning systems | G-2 Maintain electrical control circuits | G-3 Program PLCs and CNC machines for fault diagnosis | G-4 Maintain pneumatic control circuits | G-5 Troubleshoot motors | G-6 Troubleshoot centrifugal pumps | G-7 Troubleshoot positive displacement pumps | G-8 Maintain compressors | G-9 Troubleshoot blowers and fans | G-10 Install piping and plumbing | | | |
| **H** | **Repair Industrial Power Plant Systems** | H-1 Troubleshoot small gasoline engines | H-2 Troubleshoot medium size gasoline engines | H-3 Troubleshoot medium size natural gas powered engines | H-4 Troubleshoot medium size diesel engines | H-5 Troubleshoot diesel and industrial power plants | | | | | | | | |
| **I** | **Repair Power Transmission Systems** | I-1 Troubleshoot gear power transmission drives | I-2 Troubleshoot chain power transmission drives | I-3 Troubleshoot belt drive systems | I-4 Troubleshoot bearings (plane, journal and anti-friction) | I-5 Repair/ replace clutches | | | | | | | | |
| **J** | **Fabricate/ Install Sheetmetal Parts** | J-1 Layout sheetmetal parts | J-2 Form and/or bend sheetmetal parts | J-3 Fasten sheetmetal parts together | | | | | | | | | | |

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|  | Duties | Tasks |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Write Specifications For Selection of Equipment | K-1 Evaluate/ recommend electrical motors | K-2 Evaluate/ recommend pumps | K-3 Evaluate/ recommend compressors | K-4 Evaluate/ recommend hydraulic units | K-5 Requisition/order parts | K-6 Replace/ repair parts |  |  |  |  |  |  |  |
| L | Join Metal and Plastic Pipes | L-1 Solder metal pipes | L-2 Braze or silver solder metal pipes | L-3 Weld metal pipe joints | L-4 Flair metal tubing | L-5 Swage metal pipe/ tubing | L-6 Join metal pipe with threads | L-7 Join metal pipe with cement | L-8 Join metal pipes with flange joint | L-9 Join plastic pipes with glue | L-10 Join pipes with hot air welding process |  |  |  |
| M | Construct Air Distribution Systems | M-1 Fabricate loop systems | M-2 Fabricate dead end systems | M-3 Fabricate branch systems | M-4 Fabricate pipe and duct supports | M-5 Perform P.M |  |  |  |  |  |  |  |  |
| N | Start-up New Air Conditioning Systems | N-1 Check for leaks | N-2 Check for safe operation | N-3 Evacuate and charge system | N-4 Perform safe reclamation | N-5 Troubleshoot systems | N-6 Fill hydraulic systems and set flow through coils | N-7 Install thermostats and low voltage wiring | N-8 Install diffusers | N-9 Perform P.M. |  |  |  |  |
| O | Troubleshoot Hydraulic Systems | O-1 Demonstrate working knowledge of hydraulic systems | O-2 Repair/ replace pumps | O-3 Repair/ replace valves | O-4 Repair/ replace cylinders | O-5 Clean/ replace filters and fluid | O-6 Replace seals | O-7 Clean/fill reservoirs | O-8 Replace hoses and couplers | O-9 Repair/ replace motors | O-10 Perform P.M. and service as needed |  |  |  |
| P | Use Computers | P-1 Use Lotus 1-2-3 or Quattro Pro | P-2 Use WordPerfect | P-3 Work in a Windows environment | P-4 Use AUTOCAD | P-5 Use maintenance programs |  |  |  |  |  |  |  |  |
| Q | Align Shafts | Q-1 Use feeler gauges | Q-2 Use single indicator | Q-3 Use double indicator | Q-4 Use double reverse indicator |  |  |  |  |  |  |  |  |  |
| R | Install/ Align Machines | R-1 Install electrical connections | R-2 Perform required pipe fitting tasks | R-3 Grout as necessary | R-4 Perform mounting, drilling and anchoring | R-5 Level and align machine components | R-6 Discuss finishing materials (i.e., paints, sealers) | R-7 Use stud gun | R-8 Perform electrical and pneumatic drilling operations |  |  |  |  |  |
| S | Demonstrate Knowledge of Building Construction | S-1 Discuss wood framing techniques | S-2 Discuss metal framing techniques | S-3 Discuss sheeting processes | S-4 Discuss concrete forms and formula testing | S-5 Discuss grouting materials |  |  |  |  |  |  |  |  |
| T | Demonstrate Basic Electrical Skills | T-1 Read a VOM test meter | T-2 Read and use an amprobe | T-3 Use a voltage tester | T-4 Troubleshoot and repair 208-480 volts | T-5 Bend conduit | T-6 Run service from panels | T-7 Connect electrical service to machines | T-8 Troubleshoot PLCs |  |  |  |  |  |

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### SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

### AUGUSTA TECHNICAL INSTITUTE MAST PROGRAM REPRESENTATIVES

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THOMAS SANCHEZ
Instructor - Industrial Maintenance Technology

MARSHA HARRISON
Accounts Manager

### BRUNNER INDUSTRIES REPRESENTATIVES

KEVIN WERTJES
Manager Manufacturing Services

RON HUSKEY
Manager Maintenance Services

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### TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

### TOOLS AND EQUIPMENT

Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

### FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

# COMPETENCY PROFILE

# INDUSTRIAL MAINTENANCE MECHANIC

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

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## AUGUSTA TECHNICAL INSTITUTE

BRUNNER
Brunner Drilling & Manufacturing, Inc.

**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **Practice Safety** | A-1 Recognize OSHA requirements | A-2 Demonstrate use of personal protective equipment | | | | | | | | | | | |
| **B** | **Apply Mathematical Concepts** | B-1 Perform basic arithmetic functions | B-2 Convert fractions/ decimals | B-3 Convert Metric/English measurements | B-4 Perform basic algebraic operations | B-5 Perform basic trigonometric functions | B-6 Perform basic geometric calculations | | | | | | | |
| **C** | **Interpret Engineering Drawings and Control Documents** | C-1 Review blueprint notes and dimensions | C-2 Identify basic layout of drawings | C-3 Identify basic types of drawings | | | | | | | | | | |
| **D** | **Use Measuring Tools** | D-1 Use non precision measuring tools | D-2 Use precision measuring tools | D-5 Use Metric and English standards of measurement | | | | | | | | | | |
| **E** | **Use Hand Tools** | E-1 Identify and use maintenance technicians hand tools | E-2 Identify and use hand held power tools | | | | | | | | | | | |
| **F** | **Operate Machine Tools** | F-1 Operate lathe | F-2 Operate drill presses | F-3 Operate pedestal grinder | F-4 Operate surface grinder | F-5 Operate power saws | F-6 Operate hydraulic/ mechanical presses | | | | | | | |
| **G** | **Perform Welding Operations** | G-1 Weld with Shielded Metal Arc Welding (SMAW) process | G-2 Weld/cut with oxyacetylene | | | | | | | | | | | |
| **H** | **Maintain & Troubleshoot Equipment and Systems** | H-1 Maintain air conditioning systems | H-2 Maintain pneumatic control circuits | H-3 Trouble-shoot centrifugal pumps | H-4 Trouble-shoot positive displacement pumps | H-5 Maintain gate, globe, ball, plug and butterfly valves | H-6 Maintain check valves and relief valves | H-7 Trouble shoot and repair blowers | H-8 Trouble shoot, maintain, and repair hydraulic systems | | | | | |
| **I** | **Repair Power Transmission Systems** | I-1 Maintain & Trouble-shoot gear power transmission drives | I-2 Maintain & Trouble-shoot chain power transmission drives | I-3 Maintain & Trouble-shoot belt drive systems | | | | | | | | | | |
| **J** | **Fabricate/ Install Sheet Metal Parts** | J-1 Layout sheet metal parts | J-2 Form and/or bend sheet metal parts | J-3 Fasten sheet metal parts together | | | | | | | | | | |

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| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Piping Operations | K-1 Perform basic pipefitting calculations | K-2 Weld with shielded metal arc welding (SMAW) | K-3 Weld/Cut with oxyacetylene | K-4 Solder Metal Tubing | | | | | | | | | |
| L | Basic Rigging | L-1 Rigging Fundamentals | L-2 Demonstrate basic rigging skills | | | | | | | | | | | |
| M | Operate Hoisting Equipment | M-1 Move a load using a hoist | | | | | | | | | | | | |
| N | Bearing Maintenance | N-1 Remove/ install a journal bearing | N-2 Remove/ install an anti friction bearing | N-3 Install/ remove a thrust bearing | | | | | | | | | | |
| O | Use Computers | O-1 Perform basic word processing | O-2 Perform basic spread sheet operations | | | | | | | | | | | |
| P | Align Shafts | P-1 Perform alignment using feeler gauges | P-2 Perform alignment using single and reverse indicator methods | | | | | | | | | | | |
| Q | Install/ Align Machines | Q-1 Install electrical connections | Q-2 Perform required pipe fitting tasks | Q-3 Grout as necessary | Q-4 Discuss mounting methods | Q-5 Level and align machine components | Q-6 Discuss finishing materials (i.e., paints, sealers) | Q-7 Use stud gun | Q-8 Perform electrical and pneumatic drilling operations | | | | | |
| R | Maintain Electrical Devices | R-1 Use electrical test equipment | R-2 Apply specific terms to electrical circuits | R-3 Analyze series, parallel and complex DC/AC circuits | R-4 Check AC and DC motors | R-5 Trouble-shoot electrical devices | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Improvement Activities
Practice Quality-Consciousness in Performance of the Job

## CENTRAL FLORIDA COMMUNITY COLLEGE PROGRAM REPRESENTATIVES

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KEN DEWHURST
Instructor/Industrial Machinery Maintenance & Repair

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JIM WHITE, Vice President/Manufacturing
BILL RHODES, Production Manager/Body Plant
RON STEPHENS, Human Resources Manager
ELAINE SWIGART, Human Resources Supervisor
DONNA TACKETT, Health & Safety Supervisor
A. SMITH, Plant Manager/Aerial Plant
R. L'HEUREUX, Supervisor

E-ONE

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Awareness
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Electrician's Tools (lineman pliers, wire strippers, screwdrivers, wrenches, etc.)
Electric Drills and Saws
Measuring Tools
Volt-Ohm Meters
Tachometers
Amp Meters (clamp on)/Power Supplies
Caulking Guns
Wire Crimpers
Electrical Lighting Equipment
Electrical Switches
Electro-Mechanical Devices (Controls Relays, Timers, Contactors, Motor Starters, etc.)
AC Motors
DC Motors
Alternators and Generators Switchgear
General Tools (Hacksaws, Sheet Metal Snips, Diagonal Cutting Pliers, etc.)
Drills
Tapping Grinders (hand)
Hacksaws
Files
Hand Reamers

## FUTURE TRENDS AND CONCERNS

Advanced Computer Applications
Robotics
Reamers
Socket Drives
Pop Rivets

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### COMPETENCY PROFILE

# Industrial Maintenance Mechanic

Prepared by
**Central Florida Community College**

and

**Emergency One, Inc.**

E-ONE®

December 1995

**E-ONE**

## INDUSTRIAL MAINTENANCE MECHANIC...uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** Practice Safety | A-1 Demonstrate understanding of safety rules | A-2 Assume personal safety standards for self and others | A-3 Support all practices and use of protective equipment | A-4 Demonstrate an understanding of proper hazardous material handling | A-5 Know first aid and CPR | A-6 Follow safety manuals and all safety regulations/ requirements | A-7 Use protective equipment | A-8 Practice safe operating procedures for hand and machine tools | A-9 Maintain a clean and safe work environment | | | | |
| **B** Practice Total Quality | B-1 Apply principles and tools of continuous quality improvement | B-2 Understand the importance of quality in the manufacturing process | B-3 Implement concepts of quality in the workplace | B-4 Follow the Quality Plan and recommend improvements in work methods or tooling | B-5 Establish methods, plans and procedures to maintain quality | | | | | | | | |
| **C** Work Ethics | C-1 Be prompt and on the job in accordance with work schedule | C-2 Value honest work ethics and responsibility in the workplace | C-3 Demonstrate high moral values | C-4 Display a neat and clean workplace | C-5 Practice careful use and maintenance of tools and equipment | C-6 Be committed to excellence and quality | C-7 Present a good company image in attire and attitude | C-8 Support a positive work environment | C-9 Practice a positive attitude | | | | |
| **D** Demonstrate Communication Skills | D-1 Be an active listener | D-2 Demonstrate good reading, comprehension, and writing skills | D-3 Summarize and prioritize work responsibilities | D-4 Express ideas clearly | D-5 Demonstrate ability to give and follow instructions | D-6 Accept constructive criticism | | | | | | | |
| **E** Work as a Team | E-1 Understand the roles of co-workers | E-2 Respect peer relationships | E-3 Share resources to accomplish necessary tasks | E-4 Facilitate the work ethic by completing tasks on time and accurately | E-5 Be involved in problem solving | E-6 Apply creative thinking | E-7 Support a positive attitude | E-8 Encourage good feelings and morale | E-9 Understand purpose and goals of the organization | E-10 Plan and organize work as a team | E-11 Be willing to lead in areas of knowledge and expertise | E-12 Demonstrate willingness to learn new methods and skills | E-13 Demonstrate good personal relations skills |
| **F** Mathematical Skills | F-1 Exhibit understanding of basic arithmetic functions | F-2 Exhibit understanding of converting fractions and decimals | F-3 Demonstrate practical mathematics in the use of measurement tools | F-4 Interconvert Metric/ English measurements | F-5 Perform practical mathematical applications relevant to area of work | F-6 Use applied statistics, graphs, and charts for purposes of analysis and problem-solving | | | | | | | |
| **G** Engineering Drawings and Control Documents | G-1 Exhibit ability to interpret blueprint notes and dimensions | G-2 Exhibit understanding of basic layout of drawings | G-3 Exhibit understanding of basic types of drawings | G-4 Demonstrate ability to list the purpose of each type of drawing | G-5 Demonstrate ability to verify drawing elements | G-6 Practice geometric dimensioning and tolerancing methodology | G-7 Exhibit ability to read and interpret prints from different occupations | | | | | | |
| **H** Precision Measuring Tools | H-1 Exhibit ability to identify types of measurement | H-2 Exhibit ability to select proper measurement tools | H-3 Demonstrate application of proper measuring techniques | H-4 Demonstrate use of Metric and English Standards of Measurement | H-5 Perform measurements with hand held instruments | | | | | | | | |
| **I** Hand Tools | I-1 Demonstrate use of arbor and shop presses | I-2 Demonstrate use of hand files, hacksaws, and hand reamers | I-3 Exhibit use of hand threading operations, taps, and dies | I-4 Demonstrate use of hand drills and grinders | I-5 Demonstrate use of bench and pedestal grinders | I-6 Demonstrate use of impact wrenches and torque wrenches | I-7 Demonstrate safe use of air powered tools | I-8 Demonstrate use of metal snips and gasket cutters | | | | | |
| **J** Equipment and Systems | J-1 Display knowledge of troubleshooting for various equipment and systems | | | | | | | | | | | | |

E-ONE

## INDUSTRIAL MAINTENANCE MECHANIC...continued

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** Hydraulic/ Pneumatic Devices | K-1 Demonstrate use of test equipment | K-2 Describe basic principles of hydraulic systems | K-3 Identify hydraulic fluids | | | | | | | | | | |
| **L** Align Shafts | L-1 Demonstrate use of feeler gauges | L-2 Demonstrate use of single indicator | L-3 Demonstrate use of double indicator | L-4 Demonstrate use of double reverse indicator | | | | | | | | | |
| **M** Electrical Devices | M-1 Demonstrate use of electrical test equipment | M-2 Apply specific terms to electrical circuits | M-3 Exhibit ability to check AC and DC motors | | | | | | | | | | |
| **N** Emergency Vehicle Terminology | N-1 Display a general understanding of emergency vehicle terminology | N-2 Understand the functions of equipment being assembled | N-3 Understand how components relate as a total system | | | | | | | | | | |
| **O** Wellness/ Physical Abilities | O-1 Demonstrate ability to lift 50 pounds | O-2 Demonstrate ability to tolerate heights up to 100 feet | O-3 Ability to work from various positions while standing on concrete for extended periods | O-4 Display ability to work in hot/cold environment for 8-10 hours | O-5 Present a history of documented regular attendance at work | O-6 Apply wellness information to lifestyle to maintain health | | | | | | | |

### SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

### AUGUSTA TECHNICAL INSTITUTE MAST PROGRAM REPRESENTATIVES

**DR. JIM WEAVER**
MAST Site Administrator

**RONNIE LAMBERT**
MAST Site Coordinator

**STEPHEN GRIGGS**
Advisor

**PAM PHILLIPS**
Secretary

**ROBERT TANKERSLEY**
Instructor - Industrial Maintenance Technology

**THOMAS SANCHEZ**
Instructor - Industrial Maintenance Technology

**MARSHA HARRISON**
Accounts Manager

### FMC, UNITED DEFENSE INDUSTRIES REPRESENTATIVES

**JOE RIGGIO**
Engineering Manager

Plus 6 Unnamed Designers

AMTEC

### TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

### TOOLS AND EQUIPMENT

Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

### FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

# COMPETENCY PROFILE

# INDUSTRIAL MAINTENANCE MECHANIC

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

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## AUGUSTA TECHNICAL INSTITUTE

United Defense
FMC/BMY

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**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Safety | A-1 Recognize OSHA requirements | A-2 Demonstrate use of personal protective equipment | | | | | | | | | | | |
| B | Apply Mathematical Concepts | B-1 Perform basic arithmetic functions | B-2 Convert fractions/ decimals | B-3 Convert Metric/English measurements | B-4 Perform basic algebraic operations | B-5 Perform basic trigonometric functions | B-6 Perform basic geometric calculations | | | | | | | |
| C | Interpret Engineering Drawings and Control Documents | C-1 Review blueprint notes and dimensions | C-2 Identify basic layout of drawings | C-3 Identify basic types of drawings | | | | | | | | | | |
| D | Use Measuring Tools | D-1 Use non precision measuring tools | D-2 Use precision measuring tools | D-5 Use Metric and English standards of measurement | | | | | | | | | | |
| E | Use Hand Tools | E-1 Identify and use maintenance technicians hand tools | E-2 Identify and use hand held power tools | | | | | | | | | | | |
| F | Operate Machine Tools | F-1 Operate lathe | F-2 Operate drill presses | F-3 Operate pedestal grinder | F-4 Operate surface grinder | F-5 Operate power saws | F-6 Operate hydraulic/ mechanical presses | | | | | | | |
| G | Perform Welding Operations | G-1 Weld with Shielded Metal Arc Welding (SMAW) process | G-2 Weld/cut with oxyacetylene | | | | | | | | | | | |
| H | Maintain & Troubleshoot Equipment and Systems | H-1 Maintain air conditioning systems | H-2 Maintain pneumatic control circuits | H-3 Trouble-shoot centrifugal pumps | H-4 Trouble-shoot positive displacement pumps | H-5 Maintain gate, globe, ball, plug and butterfly valves | H-6 Maintain check valves and relief valves | H-7 Trouble shoot and repair blowers | H-8 Trouble shoot, maintain, and repair hydraulic systems | | | | | |
| I | Repair Power Transmission Systems | I-1 Maintain & Trouble-shoot gear power transmission drives | I-2 Maintain & Trouble-shoot chain power transmission drives | I-3 Maintain & Trouble-shoot belt drive systems | | | | | | | | | | |
| J | Fabricate/ Install Sheet Metal Parts | J-1 Layout sheet metal parts | J-2 Form and/or bend sheet metal parts | J-3 Fasten sheet metal parts together | | | | | | | | | | |

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|  | Duties | Tasks |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Piping Operations | K-1 Perform basic pipefitting calculations | K-2 Weld with shielded metal arc welding (SMAW) | K-3 Weld/Cut with oxyacetylene | K-4 Solder Metal Tubing |  |  |  |  |  |  |  |  |  |
| L | Basic Rigging | L-1 Rigging Fundamentals | L-2 Demonstrate basic rigging skills |  |  |  |  |  |  |  |  |  |  |  |
| M | Operate Hoisting Equipment | M-1 Move a load using a hoist |  |  |  |  |  |  |  |  |  |  |  |  |
| N | Bearing Maintenance | N-1 Remove/ install a journal bearing | N-2 Remove/ install an anti friction bearing | N-3 Install/ remove a thrust bearing |  |  |  |  |  |  |  |  |  |  |
| O | Use Computers | O-1 Perform basic word processing | O-2 Perform basic spread sheet operations |  |  |  |  |  |  |  |  |  |  |  |
| P | Align Shafts | P-1 Perform alignment using feeler gauges | P-2 Perform alignment using single and reverse indicator methods |  |  |  |  |  |  |  |  |  |  |  |
| Q | Install/ Align Machines | Q-1 Install electrical connections | Q-2 Perform required pipe fitting tasks | Q-3 Grout as necessary | Q-4 Discuss mounting methods | Q-5 Level and align machine components | Q-6 Discuss finishing materials (i.e., paints, sealers) | Q-7 Use stud gun | Q-8 Perform electrical and pneumatic drilling operations |  |  |  |  |  |
| R | Maintain Electrical Devices | R-1 Use electrical test equipment | R-2 Apply specific terms to electrical circuits | R-3 Analyze series, parallel and complex DC/AC circuits | R-4 Check AC and DC motors | R-5 Trouble-shoot electrical devices |  |  |  |  |  |  |  |  |
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## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

## TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

DR. HUGH ROGERS
Director

DR. JON BOTSFORD
Assistant Director

JOE PENICK
Project Coordinator

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WALLACE PELTON
Site Coordinator

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Senior Secretary/Statistician

**Furnished By:**

**RICKY FLAK**
Vice President - Operations

**NICK NICHOLS**
Manufacturing Manager -
Diamond Products

**HORACE ROBERTS**
Senior Machine Tool Technician
and Industrial Maintenance Mechanic

Texas State
Technical College
Waco

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

## FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

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## COMPETENCY PROFILE

# Industrial Maintenance Mechanic

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

SMITH GEODIAMOND

**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | **Practice Safety** | A-1 Follow safety manuals and all safety regulations/requirements | A-2 Use protective equipment | A-3 Follow safe operating procedures for hand and machine tools | A-4 Maintain a clean and safe work environment | | | | | | | | | |
| B | **Operate Machine Tools** | B-1 Operate lathes | B-2 Operate milling machines | B-3 Operate drill presses | B-4 Operate boring machines | B-5 Operate pedestal grinders | B-6 Operate surface grinders | B-7 Operate bandsaws | B-8 Operate shapers | B-9 Operate metal shears | B-10 Operate brakes | B-11 Operate cut off saws | B-12 Replace parts, such as bushings, shafts and keys | |
| C | **Use Precision Measuring Tools** | C-1 Measure with steel rules | C-2 Measure with all types of micrometers | C-3 Measure with transfer type measuring instruments | C-4 Align work with dial indicators | C-5 Measure with dial calipers | C-6 Lay out with height gage | C-7 Use gage blocks | C-8 Use inch and metric systems | C-9 Use laser equipment for machine leveling and alignment | | | | |
| D | **Use Hand Tools** | D-1 Use files | D-2 Use taps | D-3 Use dies | D-4 Install helicoils | D-5 Use drill motors | D-6 Use impact wrenches | D-7 Use torque wrenches | D-8 Use hacksaws | D-9 Use gasket cutters | D-10 Install safety wire | D-11 Use wrenches of various types | D-12 Use vises | D-13 Use hole saws |
| E | **Use Welding Processes** | E-1 Weld using SMAW process in different positions | E-2 Weld different types of joints using the SMAW process | E-3 Cut/weld using the oxyacetylene process in different positions | E-4 Cut/weld different types of joints with oxyacetylene | E-5 Weld with GTAW (heliarc) | E-6 Weld with GMAW (mig) | E-7 Perform Plasma Arc cutting | E-8 Fabricate machinery guards | E-9 Weld cast iron, aluminum, steel, and braze materials | | | | |
| F | **Read/ Interpret Prints** | F-1 Interpret mechanical prints | F-2 Interpret electrical prints | F-3 Interpret pneumatic schematics | F-4 Interpret hydraulic schematics | F-5 Interpret welding prints | F-6 Interpret building prints | F-7 Interpret plumbing or piping prints | F-8 Interpret conveyor system prints | F-9 Understand bill of materials callouts | | | | |
| G | **Troubleshoot Equipment and Systems** | G-1 Maintain air conditioning systems | G-2 Maintain electrical control circuits | G-3 Program PLCs and understand fault codes | G-4 Maintain pneumatic control circuits | G-5 Troubleshoot motors | G-6 Troubleshoot centrifugal pumps | G-7 Troubleshoot positive displacement pumps | G-8 Maintain compressors | G-9 Troubleshoot blowers | G-10 Understand turbines (gas, steam) | G-11 Install piping | | |
| H | **Repair Industrial Conveyor or Transport Systems** | H-1 Troubleshoot small gasoline engines | H-2 Troubleshoot medium size gasoline engines | H-3 Troubleshoot medium size natural gas powered engines | H-4 Troubleshoot medium size diesel engines | H-5 Troubleshoot diesel and industrial power plants | H-6 Troubleshoot steam turbines | H-7 Troubleshoot gas turbines | | | | | | |
| I | **Repair Power Transmission Systems** | I-1 Troubleshoot gear power transmission drives | I-2 Troubleshoot chain power transmission drives | I-3 Troubleshoot belt drive systems | I-4 Troubleshoot bearings (plane, journal and anti-friction) | I-5 Repair/ replace clutches | I-6 Repair/ replace helical gears | I-7 Use metric and standard gear gages | | | | | | |
| J | **Fabricate/ Install Sheet Metal Parts** | J-1 Layout sheet metal parts | J-2 Form and/or bend sheet metal parts | J-3 Fasten sheet metal parts together | J-4 Machine composites and apply bonding materials | | | | | | | | | |

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| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** | **Write Specifications For Selection of Equipment** | K-1 Evaluate/ recommend furnaces or heat treating equipment | K-2 Evaluate/ recommend pumps | K-3 Evaluate/ recommend compressors | K-4 Evaluate/ recommend hydraulic units | K-5 Requisition/order parts | K-6 Replace/ repair parts | | | | | | | |
| **L** | **Join Pipes** | L-1 Solder metal pipes | L-2 Braze or silver solder metal pipes | L-3 Weld metal pipe joints | L-4 Flair metal tubing | L-5 Swage metal pipe/ tubing | L-6 Join metal pipe with threads | L-7 Join metal pipe with cement | L-8 Join metal pipes with flange joint | L-9 Join plastic pipes with glue | L-10 Join plastic pipes with hot air welding process | | | |
| **M** | **Construct Air Distribution Systems** | M-1 Fabricate loop systems | M-2 Fabricate dead end systems | M-3 Fabricate branch systems | M-4 Install pipe and duct supports | M-5 Perform P.M. | | | | | | | | |
| **N** | **Troubleshoot Hydraulic/ Pneumatic Systems** | N-1 Demonstrate working knowledge of hydraulic/pneumatic systems | N-2 Repair/ replace pumps | N-3 Repair/ replace valves | N-4 Repair/ replace cylinders (hydraulic and pneumatic) | N-5 Clean/ replace filters | N-6 Replace seals | N-7 Clean/fill reservoirs | N-8 Replace hoses and couplers | N-9 Repair/ replace motors | N-10 Perform P.M. and service as needed | | | |
| **O** | **Use Computers** | O-1 Use Lotus 1-2-3 or Quattro Pro | O-2 Use WordPerfect | O-3 Work in a Windows environment | O-4 Use AUTOCAD | O-5 Use maintenance programs | O-6 Program ladder logic for PLCs | | | | | | | |
| **P** | **Align Shafts** | P-1 Use feeler gauges | P-2 Use single indicator | P-3 Use double indicator | P-4 Use double reverse indicator | P-5 Use Laser | | | | | | | | |
| **Q** | **Install/ Align Machines** | Q-1 Install electrical connections | Q-2 Perform required pipe fitting tasks | Q-3 Grout as necessary | Q-4 Discuss mounting methods | Q-5 Level and align machine components | Q-6 Discuss finishing materials (i.e., paints, sealers) | Q-7 Use stud gun | Q-8 Perform electrical and pneumatic drilling operations | | | | | |
| **R** | **Demonstrate Knowledge of Building Construction** | R-1 Discuss wood framing techniques | R-2 Discuss metal framing techniques | R-3 Discuss shooting processes | R-4 Discuss concrete forms and formula testing | R-5 Discuss grouting materials | R-6 Discuss surveying applications and methods | | | | | | | |
| **S** | **Demonstrate Basic Electrical Skills** | S-1 Read a VOM test meter | S-2 Read and use an amprobe | S-3 Use a voltage tester | S-4 Troubleshoot and repair 208-480 volts | S-5 Bend conduit | S-6 Run service from panels | S-7 Connect electrical service to machines | S-8 Troubleshoot PLCs | | | | | |

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## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
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Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

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THOMAS SANCHEZ
Instructor - Industrial Maintenance Technology

MARSHA HARRISON
Accounts Manager

## GREENFIELD INDUSTRIES REPRESENTATIVE

DWAYNE STEPHENS
Training Manager

AMTEC

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

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Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

## FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

---

# COMPETENCY PROFILE

# INDUSTRIAL MAINTENANCE MECHANIC

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

AMTEC

## AUGUSTA TECHNICAL INSTITUTE

GREENFIELD
INDUSTRIES

**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Safety | A-1 Recognize OSHA requirements | A-2 Demonstrate use of personal protective equipment | | | | | | | | | | | |
| B | Apply Mathematical Concepts | B-1 Perform basic arithmetic functions | B-2 Convert fractions/ decimals | B-3 Convert Metric/English measurements | B-4 Perform basic algebraic operations | B-5 Perform basic trigonometric functions | B-6 Perform basic geometric calculations | | | | | | | |
| C | Interpret Engineering Drawings and Control Documents | C-1 Review blueprint notes and dimensions | C-2 Identify basic layout of drawings | C-3 Identify basic types of drawings | | | | | | | | | | |
| D | Use Measuring Tools | D-1 Use non precision measuring tools | D-2 Use precision measuring tools | D-5 Use Metric and English standards of measurement | | | | | | | | | | |
| E | Use Hand Tools | E-1 Identify and use maintenance technicians hand tools | E-2 Identify and use hand held power tools | | | | | | | | | | | |
| F | Operate Machine Tools | F-1 Operate lathe | F-2 Operate drill presses | F-3 Operate pedestal grinder | F-4 Operate surface grinder | F-5 Operate power saws | F-6 Operate hydraulic/ mechanical presses | | | | | | | |
| G | Perform Welding Operations | G-1 Weld with Shielded Metal Arc Welding (SMAW) process | G-2 Weld/cut with oxyacetylene | | | | | | | | | | | |
| H | Maintain & Troubleshoot Equipment and Systems | H-1 Maintain air conditioning systems | H-2 Maintain pneumatic control circuits | H-3 Trouble-shoot centrifugal pumps | H-4 Trouble-shoot positive displacement pumps | H-5 Maintain gate, globe, ball, plug and butterfly valves | H-6 Maintain check valves and relief valves | H-7 Trouble shoot and repair blowers | H-8 Trouble shoot, maintain, and repair hydraulic systems | | | | | |
| I | Repair Power Transmission Systems | I-1 Maintain & Trouble-shoot gear power transmission drives | I-2 Maintain & Trouble-shoot chain power transmission drives | I-3 Maintain & Trouble-shoot belt drive systems | | | | | | | | | | |
| J | Fabricate/ Install Sheet Metal Parts | J-1 Layout sheet metal parts | J-2 Form and/or bend sheet metal parts | J-3 Fasten sheet metal parts together | | | | | | | | | | |

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|  | Duties | Tasks |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Piping Operations | K-1 Perform basic pipefitting calculations | K-2 Weld with shielded metal arc welding (SMAW) | K-3 Weld/Cut with oxyacetylene | K-4 Solder Metal Tubing |  |  |  |  |  |  |  |  |  |
| L | Basic Rigging | L-1 Rigging Fundamentals | L-2 Demonstrate basic rigging skills |  |  |  |  |  |  |  |  |  |  |  |
| M | Operate Hoisting Equipment | M-1 Move a load using a hoist |  |  |  |  |  |  |  |  |  |  |  |  |
| N | Bearing Maintenance | N-1 Remove/ install a journal bearing | N-2 Remove/ install an anti friction bearing | N-3 Install/ remove a thrust bearing |  |  |  |  |  |  |  |  |  |  |
| O | Use Computers | O-1 Perform basic word processing | O-2 Perform basic spread sheet operations |  |  |  |  |  |  |  |  |  |  |  |
| P | Align Shafts | P-1 Perform alignment using feeler gauges | P-2 Perform alignment using single and reverse indicator methods |  |  |  |  |  |  |  |  |  |  |  |
| Q | Install/ Align Machines | Q-1 Install electrical connections | Q-2 Perform required pipe fitting tasks | Q-3 Grout as necessary | Q-4 Discuss mounting methods | Q-5 Level and align machine components | Q-6 Discuss finishing materials (i.e., paints, sealers) | Q-7 Use stud gun | Q-8 Perform electrical and pneumatic drilling operations |  |  |  |  |  |
| R | Maintain Electrical Devices | R-1 Use electrical test equipment | R-2 Apply specific terms to electrical circuits | R-3 Analyze series, parallel and complex DC/AC circuits | R-4 Check AC and DC motors | R-5 Trouble-shoot electrical devices |  |  |  |  |  |  |  |  |
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**SKILLS AND KNOWLEDGE**
Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

**AUGUSTA TECHNICAL INSTITUTE
MAST PROGRAM REPRESENTATIVES**

DR. JIM WEAVER
MAST Site Administrator

RONNIE LAMBERT
MAST Site Coordinator

STEPHEN GRIGGS
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PAM PHILLIPS
Secretary

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THOMAS SANCHEZ
Instructor - Industrial Maintenance Technology

MARSHA HARRISON
Accounts Manager

**KAISER ALUMINUM
REPRESENTATIVES**

JIM KOLI
Manufacturing Engineer

TONY SMITH
Management Facilitator

AMTEC

**TRAITS AND ATTITUDES**
Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

**TOOLS AND EQUIPMENT**
Mechanic's Tools (e.g., toolbox, wrenches,
sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

**FUTURE TRENDS AND CONCERNS**
Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

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# COMPETENCY PROFILE

# INDUSTRIAL MAINTENANCE MECHANIC

**Prepared By
M.A.S.T.
Machine Tool Advanced Skills
Technology Program
and
Consortia Partners
(V.199J40008)**

AMTEC

## AUGUSTA TECHNICAL INSTITUTE

## KAISER ALUMINUM

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**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | **Practice Safety** | A-1 Recognize OSHA requirements | A-2 Demonstrate use of personal protective equipment | | | | | | | | | | | |
| **B** | **Apply Mathematical Concepts** | B-1 Perform basic arithmetic functions | B-2 Convert fractions/ decimals | B-3 Convert Metric/English measurements | B-4 Perform basic algebraic operations | B-5 Perform basic trigonometric functions | B-6 Perform basic geometric calculations | | | | | | | |
| **C** | **Interpret Engineering Drawings and Control Documents** | C-1 Review blueprint notes and dimensions | C-2 Identify basic layout of drawings | C-3 Identify basic types of drawings | | | | | | | | | | |
| **D** | **Use Measuring Tools** | D-1 Use non precision measuring tools | D-2 Use precision measuring tools | D-5 Use Metric and English standards of measurement | | | | | | | | | | |
| **E** | **Use Hand Tools** | E-1 Identify and use maintenance technicians hand tools | E-2 Identify and use hand held power tools | | | | | | | | | | | |
| **F** | **Operate Machine Tools** | F-1 Operate lathe | F-2 Operate drill presses | F-3 Operate pedestal grinder | F-4 Operate surface grinder | F-5 Operate power saws | F-6 Operate hydraulic/ mechanical presses | | | | | | | |
| **G** | **Perform Welding Operations** | G-1 Weld with Shielded Metal Arc Welding (SMAW) process | G-2 Weld/cut with oxyacetylene | | | | | | | | | | | |
| **H** | **Maintain & Troubleshoot Equipment and Systems** | H-1 Maintain air conditioning systems | H-2 Maintain pneumatic control circuits | H-3 Trouble-shoot centrifugal pumps | H-4 Trouble-shoot positive displacement pumps | H-5 Maintain gate, globe, ball, plug and butterfly valves | H-6 Maintain check valves and relief valves | H-7 Trouble shoot and repair blowers | H-8 Trouble shoot, maintain, and repair hydraulic systems | | | | | |
| **I** | **Repair Power Transmission Systems** | I-1 Maintain & Trouble-shoot gear power transmission drives | I-2 Maintain & Trouble-shoot chain power transmission drives | I-3 Maintain & Trouble-shoot belt drive systems | | | | | | | | | | |
| **J** | **Fabricate/ Install Sheet Metal Parts** | J-1 Layout sheet metal parts | J-2 Fasten sheet metal parts together | | | | | | | | | | | |

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[illegible]

| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | Piping Operations | K-1 Perform basic pipefitting calculations | K-2 Weld with shielded metal arc welding (SMAW) | K-3 Weld/Cut with oxyacetylene | K-4 Solder Metal Tubing | | | | | | | | | |
| L | Basic Rigging | L-1 Rigging Fundamentals | L-2 Demonstrate basic rigging skills | | | | | | | | | | | |
| M | Operate Hoisting Equipment | M-1 Move a load using a hoist | | | | | | | | | | | | |
| N | Bearing Maintenance | N-1 Remove/ install a journal bearing | N-2 Remove/ install an anti friction bearing | N-3 Install/ remove a thrust bearing | | | | | | | | | | |
| O | Use Computers | O-1 Perform basic word processing | O-2 Perform basic spread sheet operations | | | | | | | | | | | |
| P | Align Shafts | P-1 Perform alignment using feeler gauges | P-2 Perform alignment using single and reverse indicator methods | | | | | | | | | | | |
| Q | Install/ Align Machines | Q-1 Install electrical connections | Q-2 Perform required pipe fitting tasks | Q-3 Grout as necessary | Q-4 Discuss mounting methods | Q-5 Level and align machine components | Q-6 Discuss finishing materials (i.e., paints, sealers) | Q-7 Use stud gun | Q-8 Perform electrical and pneumatic drilling operations | | | | | |
| R | Maintain Electrical Devices | R-1 Use electrical test equipment | R-2 Apply specific terms to electrical circuits | R-3 Analyze series, parallel and complex DC/AC circuits | R-4 Check AC and DC motors | R-5 Trouble-shoot electrical devices | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

### SKILLS AND KNOWLEDGE

- Communication Skills
- Use Measurement Tools
- Use Inspection Devices
- Mathematical Skills
- Reading/Writing Skills
- Knowledge of Safety Regulations
- Practice Safety in the Workplace
- Organizational Skills
- Knowledge of Company Policies/Procedures
- Mechanical Aptitude
- Ability to Comprehend Written/Verbal Instructions
- Basic Knowledge of Fasteners
- Ability to Work as Part of a Team
- Converse in the Technical Language of the Trade
- Knowledge of Occupational Opportunities
- Knowledge of Employee/Employer Responsibilities
- Knowledge of Company Quality Assurance Activities
- Practice Quality-Consciousness in Performance of the Job

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Director

DR. JON BOTSFORD
Assistant Director

JOE PENICK
Project Coordinator

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

**Furnished By:**

MARTY SCHMIDT
Senior Manufacturing Engineer
and Systems Design Engineer

MICHAEL KON
Manufacturing Engineer and
CNC Systems/Program Engineer

Texas State
Technical College
Waco

### TRAITS AND ATTITUDES

- Strong Work Ethic
- Interpersonal Skills
- Punctuality
- Dependability
- Honesty
- Neatness
- Safety Conscientious
- Motivation
- Responsible
- Physical Ability
- Professional
- Trustworthy
- Customer Relations
- Personal Ethics

### TOOLS AND EQUIPMENT

- Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
- Measuring Tools
- Power Tools
- Drill Presses
- Power Saws
- Power Drills
- Hydraulic/Arbor Press
- Welding Equipment (SMAW, GMAW, FCAW, Plasma)
- Alignment/Calibration Tools
- Computer
- Forklift
- Personal Safety Equipment
- Oxyacetylene Equipment
- Tool Storage Equipment
- Workbenches
- Vises
- Pedestal Grinders
- Pipe Threading Dies
- Pipe/Conduit Bending Equipment
- A/C Service Equipment
- Steam/Boiler System Equipment
- Power Transmission Devices
- Gasoline Power Plant
- Diesel Power Plant
- Hydraulic Training Equipment
- Electrical Testing Equipment
- Air Compressor
- Air Powered Tools
- Hydraulic Jack
- Chain Hoist

### FUTURE TRENDS AND CONCERNS

- Statistical Process Control
- Composites
- Laser Alignment
- Advanced Computer Applications
- Robotics
- Environmental Concerns
- Fiber Optic Controls
- Automated Material Handling Equipment
- More Sophisticated Computer Controls
- Hazardous Materials Handling

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## COMPETENCY PROFILE

# Industrial Maintenance Mechanic

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

LOCKHEED MARTIN

**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Operate Machine Tools | A-1 Operate lathes | A-2 Operate milling machines | A-3 Operate drill presses | A-4 Operate boring machines | A-5 Operate pedestal grinders | A-6 Operate surface grinders | A-7 Operate bandsaws | A-8 Operate shapers | A-9 Operate metal shears | A-10 Operate brakes | A-11 Operate cut off saws | | |
| B | Use Precision Measuring Tools | B-1 Measure with steel rules | B-2 Measure with micrometers | B-3 Measure with transfer type measuring instruments | B-4 Align work with dial indicators | B-5 Measure with dial calipers | B-6 Lay out with height gage | B-7 Use gage blocks | B-8 Use inch and metric systems | | | | | |
| C | Use Hand Tools | C-1 Use files | C-2 Use taps | C-3 Use dies | C-4 Install helicoils | C-5 Use drill motors | C-6 Use impact wrenches | C-7 Use torque wrenches | C-8 Use hacksaws | C-9 Use gasket cutters | C-10 Install safety wire | C-11 Use wrenches of various types | C-12 Use vises | |
| D | Discuss Various Production Processes | D-1 Weld using SMAW process in different positions | D-2 Weld different types of joints using the SMAW process | D-3 Cut/weld using the oxyacetylene process in different positions | D-4 Cut/weld different types of joints with oxyacetylene | D-5 Weld with GTAW (heliarc) | D-6 Weld with GMAW (mig) | D-7 Perform Plasma Arc cutting | D-8 Fabricate machinery guards | | | | | |
| E | Read/ Interpret Prints | E-1 Interpret mechanical prints | E-2 Interpret electrical prints | E-3 Interpret pneumatic schematics | E-4 Interpret hydraulic schematics | E-5 Interpret welding prints | E-6 Interpret building prints | E-7 Interpret plumbing or piping prints | E-8 Interpret conveyor system prints | E-9 Understand bill of materials callouts | | | | |
| F | Troubleshoot Equipment and Systems | F-1 Maintain air conditioning systems | F-2 Maintain electrical control circuits | F-3 Program PLCs | F-4 Maintain pneumatic control circuits | F-5 Troubleshoot motors | F-6 Troubleshoot centrifugal pumps | F-7 Troubleshoot positive displacement pumps | F-8 Maintain compressors | F-9 Troubleshoot blowers | F-10 Understand turbines (gas, steam) | F-11 Install piping | | |
| G | Repair Industrial Power Plant Systems | G-1 Troubleshoot small gasoline engines | G-2 Troubleshoot medium size gasoline engines | G-3 Troubleshoot medium size natural gas powered engines | G-4 Troubleshoot medium size diesel engines | G-5 Troubleshoot diesel and industrial power plants | G-6 Troubleshoot steam turbines | G-7 Troubleshoot gas turbines | | | | | | |
| H | Repair Power Transmission Systems | H-1 Troubleshoot gear power transmission drives | H-2 Troubleshoot chain power transmission drives | H-3 Troubleshoot belt drive systems | H-4 Troubleshoot bearings (plane, journal and anti-friction) | H-5 Repair/ replace clutches | | | | | | | | |
| I | Fabricate/ Install Sheetmetal Parts | I-1 Layout sheetmetal parts | I-2 Form and/or bend sheetmetal parts | I-3 Fasten sheetmetal parts together | | | | | | | | | | |
| J | Write Specifications For Selection of Equipment | J-1 Evaluate/ recommend condensing units | J-2 Evaluate/ recommend furnaces | J-3 Evaluate/ recommend chillers | J-4 Evaluate/ recommend cooling towers | J-5 Evaluate/ recommend pumps | J-6 Evaluate/ recommend compressors | J-7 Evaluate/ recommend hydraulic units | J-8 Requisition/ order parts | J-9 Replace/ repair parts | | | | |

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| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | **Join Plastic Pipes** | K-1 Join pipes with glue | K-2 Join pipes with hot air welding process | | | | | | | | | | | |
| L | **Join Metal Pipes** | L-1 Solder pipes | L-2 Braze or silver solder pipes | L-3 Weld pipe joints | L-4 Flair metal tubing | L-5 Swage metal pipe/ tubing | L-6 Join pipe with threads | L-7 Join pipe with cement | L-8 Join pipes with flange joint | | | | | |
| M | **Construct Air Distribution Systems** | M-1 Fabricate loop systems | M-2 Fabricate dead end systems | M-3 Fabricate branch systems | M-4 Fabricate pipe and duct supports | M-5 Perform P.M. | | | | | | | | |
| N | **Start-up New Air Conditioning Systems** | N-1 Check for leaks | N-2 Check for safe operation | N-3 Evacuate and charge system | N-4 Perform safe reclamation | N-5 Trouble-shoot systems | N-6 Fill hydraulic systems and set flow through coils | N-7 Install thermostats and low voltage wiring | N-8 Install diffusers | N-9 Perform P.M. | | | | |
| O | **Maintain Boiler and Steam Systems** | O-1 Trouble-shoot systems | O-2 Adjust systems for optimum performance | O-3 Perform P.M. | | | | | | | | | | |
| P | **Troubleshoot Hydraulic Systems** | P-1 Demonstrate working knowledge of hydraulic systems | P-2 Repair/ replace pumps | P-3 Repair/ replace valves | P-4 Repair/ replace cylinders | P-5 Clean/ replace filters | P-6 Replace seals | P-7 Clean/fill reservoirs | P-8 Replace hoses and couplers | P-9 Repair/ replace motors | P-10 Perform P.M. and service as needed | P-11 Perform P.M. | | |
| Q | **Perform Non-Destructive Testing** | Q-1 Make industrial x-ray inspection | Q-2 Test using ultrasonic process | Q-3 Test using vibration analysis | Q-4 Balance rotating equipment | | | | | | | | | |
| R | **Use Computers** | R-1 Use Lotus 1-2-3 or Quattro Pro | R-2 Use Word Perfect | R-3 Work in a Windows environment | R-4 Use AUTOCAD | R-5 Use maintenance programs | R-6 Program ladder logic for PLCs | | | | | | | |
| S | **Align Shafts** | S-1 Use feeler gauges | S-2 Use single indicator | S-3 Use double indicator | S-4 Use double reverse indicator | S-5 Use Laser | | | | | | | | |
| T | **Install/ Align Machines** | T-1 Install electrical connections | T-2 Perform required pipe fitting tasks | T-3 Grout as necessary | T-4 Discuss mounting methods | T-5 Level and align machine components | T-6 Discuss finishing materials (i.e., paints, sealers) | T-7 Use stud gun | T-8 Perform electrical and pneumatic drilling operations | | | | | |

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| Duties | | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **U** | **Demonstrate Knowledge of Building Construction** | U-1 Discuss wood framing techniques | U-2 Discuss metal framing techniques | U-3 Discuss sheeting processes | U-4 Discuss concrete forms and formula testing | U-5 Discuss grouting materials | U-6 Discuss surveying applications and methods | | | | | | | |
| **V** | **Demonstrate Basic Electrical Skills** | V-1 Read a VOM test meter | V-2 Read and use an amprobe | V-3 Use a voltage tester | V-4 Trouble-shoot and repair 208-480 volts | V-5 Bend conduit | V-6 Run service from panels | V-7 Connect electrical service to machines | V-8 Trouble-shoot PLCs | | | | | |
| **W** | **Perform Conventional Machining Operations** | W-1 Prepare and plan for machining operations | W-2 Use proper hand tools | W-3 Set up/ operate power saws | W-4 Set up/ operate drill presses | W-5 Set up/ operate vertical milling machines | W-6 Set up/ operate horizontal milling machines | W-7 Set up/ operate metal cutting lathes | W-8 Set up/ operate surface grinders | W-9 Set up/ operate OD/ID grinders | W-10 Set up/ operate jig bore/jig grinding machines | W-11 Set up/ operate EDM | | |

### SKILLS AND KNOWLEDGE

- Communication Skills
- Use Measurement Tools
- Use Inspection Devices
- Mathematical Skills
- Reading/Writing Skills
- Knowledge of Safety Regulations
- Practice Safety in the Workplace
- Organizational Skills
- Knowledge of Company Policies/Procedures
- Mechanical Aptitude
- Ability to Comprehend Written/Verbal Instructions
- Knowledge of Cutting Fluids/Lubricants
- Basic Knowledge of Fasteners
- Ability to Work as Part of a Team
- Converse in the Technical Language of the Trade
- Knowledge of Occupational Opportunities
- Knowledge of Employee/Employer Responsibilities
- Knowledge of Company Quality Assurance Activities
- Practice Quality-Consciousness in Performance of the Job
- Knowledge of Manufacturing Processes

### TEXAS STATE TECHNICAL COLLEGE WACO MAST PROGRAM REPRESENTATIVES

DR. HUGH K. ROGERS
Director

JOE PENICK
Project Coordinator

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

**Furnished By:**

DON BRIGHT

VINCE GEHRIN
Specialist, Technical Training

Texas State
Technical College
Waco

### TRAITS AND ATTITUDES

- Strong Work Ethic
- Interpersonal Skills
- Punctuality
- Dependability
- Honesty
- Neatness
- Safety Conscientious
- Motivation
- Responsible
- Physical Ability
- Professional
- Trustworthy
- Customer Relations
- Personal Ethics

### TOOLS AND EQUIPMENT

- Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc
- Measuring Tools
- Power Tools
- Drill Presses
- Power Saws
- Power Drills
- Hydraulic/Arbor Press
- Alignment/Calibration Tools
- Computer
- Forklift
- Personal Safety Equipment
- Oxyacetylene Equipment
- Tool Storage Equipment
- Workbenches
- Vises
- Pedestal Grinders
- Pipe Threading Dies
- Pipe/Conduit Bending Equipment
- A/C Service Equipment
- Power Transmission Devices
- Hydraulic Training Equipment
- Electrical Testing Equipment
- Air Compressor
- Air Powered Tools
- Hydraulic Jack
- Chain Hoist

### FUTURE TRENDS AND CONCERNS

- Statistical Process Control
- Composites
- Laser Alignment
- Advanced Computer Applications
- Robotics
- Environmental Concerns
- Fiber Optic Controls
- Automated Material Handling Equipment
- More Sophisticated Computer Controls
- Hazardous Materials Handling

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## COMPETENCY PROFILE

# Industrial Maintenance Mechanic

**Prepared By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
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Texas State
Technical College
Waco

**MCDONNELL DOUGLAS**

**INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.**

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Practice Safety | A-1 Follow safety manuals and all safety regulations/ requirements | A-2 Set up and use welding equipment | A-3 Wear personal safety equipment | A-4 Maintain a clean and safe work environment | | | | | | | | | |
| B | Operate Machine Tools | B-1 Operate lathes | B-2 Operate milling machines | B-3 Operate drill presses | B-4 Operate boring machines | B-5 Operate pedestal grinders | B-6 Operate surface grinders | B-7 Operate bandsaws | B-8 Operate shapers | B-9 Operate metal shears | B-10 Operate brakes | B-11 Operate cut off saws | B-12 Operate and repair maintenance service equipment | |
| C | Use Precision Measuring Tools | C-1 Measure with steel rules | C-2 Measure with micrometers | C-3 Measure with transfer type measuring instruments | C-4 Align work with dial indicators | C-5 Measure with dial calipers | C-6 Lay out with height gage | C-7 Use gage blocks | C-8 Use inch and metric system | C-9 Use Laser measuring devices | C-10 Use computer based ball bar | C-11 Use vibration analyzer | | |
| D | Use Hand Tools | D-1 Use files | D-2 Use taps | D-3 Use dies | D-4 Install helicoils | D-5 Use drill motors | D-6 Use impact and torque wrenches | D-7 Use hacksaws | D-8 Use gasket cutters | D-9 Install safety wire | D-10 Use wrenches of various types | D-11 Use vises | | |
| E | Perform Various Production Processes | E-1 Cut/weld using the oxyacetylene process in different positions | E-2 Cut/weld different types of joints with oxyacetylene | E-3 Weld with GMAW (mig) | E-4 Fabricate machinery guards | E-5 Solder and braze tubing | | | | | | | | |
| F | Read/ Interpret Prints | F-1 Interpret mechanical prints | F-2 Interpret electrical prints | F-3 Interpret pneumatic schematics | F-4 Interpret hydraulic schematics | F-5 Interpret welding prints | F-6 Interpret building prints | F-7 Interpret plumbing or piping prints | F-8 Interpret conveyor system prints | F-9 Understand bill of materials callouts | | | | |
| G | Troubleshoot Equipment and Systems | G-1 Maintain cooling systems | G-2 Program PLCs | G-3 Maintain pneumatic control circuits | G-4 Install electrical coupling | G-5 Troubleshoot centrifugal pumps | G-6 Troubleshoot positive displacement pumps | G-7 Maintain compressors | G-8 Troubleshoot blowers | G-9 Install piping | | | | |
| H | Repair Power Transmission Systems | H-1 Troubleshoot gear power transmission drives | H-2 Troubleshoot chain power transmission drives | H-3 Troubleshoot belt drive systems | H-4 Troubleshoot bearings (plane, journal and anti-friction) | H-5 Repair/ replace clutches | | | | | | | | |
| I | Fabricate/ Install Sheet Metal Parts | I-1 Layout sheet metal parts | I-2 Form and/or bend sheet metal parts | I-3 Fasten sheet metal parts together | | | | | | | | | | |
| J | Write Specifications For Selection of Equipment | J-1 Evaluate/ recommend cooling condensing units | J-2 Evaluate/ recommend furnaces | J-3 Evaluate/ recommend chillers | J-4 Evaluate/ recommend cooling towers | J-5 Evaluate/ recommend pumps | J-6 Evaluate/ recommend compressors | J-7 Evaluate/ recommend hydraulic units | J-8 Requisition/ order parts | J-9 Replace/ repair parts | | | | |

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| Duties | | ← Tasks → | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | **Join Metal and Plastic Pipes** | K-1 Solder metal pipes | K-2 Braze or silver solder metal pipes | K-3 Weld metal pipe joints | K-4 Flair metal tubing | K-5 Swage metal pipe/ tubing | K-6 Join metal pipe with threads | K-7 Join metal pipe with cement | K-8 Join metal pipes with flange joint | K-9 Join plastic pipes with glue | | | | |
| L | **Construct Air Distribution Systems** | L-1 Fabricate loop systems | L-2 Fabricate dead end systems | L-3 Fabricate branch systems | L-4 Perform PM | | | | | | | | | |
| M | **Repair Heat Exchangers and Coolers** | M-1 Check for safe operation | M-2 Trouble-shoot systems | M-3 Fill hydraulic systems and set flow through coils | M-4 Install thermostats and low voltage wiring | M-5 Install diffusers | M-6 Perform PM | | | | | | | |
| N | **Troubleshoot Hydraulic Systems** | N-1 Demonstrate working knowledge of hydraulic systems | N-2 Repair/ replace pumps | N-3 Repair/ replace valves | N-4 Repair/ replace cylinders | N-5 Clean/ replace filters | N-6 Replace seals | N-7 Clean/fill reservoirs | N-8 Replace hoses and couplers | N-9 Repair/ replace motors | N-10 Perform PM and service as needed | | | |
| O | **Use Computers** | O-1 Use word processing applications | O-2 Work in a Windows environment | O-3 Use CAD | O-4 Use maintenance programs | O-5 Program ladder logic for PLCs | O-6 Use computer based maintenance systems | O-7 Use automated inventory system | O-8 Use CNC and NC network programs | | | | | |
| P | **Align Shafts** | P-1 Use feeler gauges | P-2 Use single indicator | P-3 Use double indicator | P-4 Use double reverse indicator | | | | | | | | | |
| Q | **Install/ Align Machines** | Q-1 Discuss mounting methods | Q-2 Level and align machine components | Q-3 Use stud gun | Q-4 Perform electrical and pneumatic drilling operations | Q-5 Use computer based laser for alignment | | | | | | | | |

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### SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Knowledge of Company Policies/Procedures
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Assurance Activities
Practice Quality-Consciousness in Performance of the Job

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Director

DR. JON BOTSFORD
Assistant Director

TERRY SAWMA
Research Coordinator

WALLACE PELTON
Site Coordinator

ROSE MARY TIMMONS
Senior Secretary/Statistician

### REED TOOL COMPANY REPRESENTATIVE

LINCOLN JANISCH
Maintenance Supervisor

Texas State
Technical College
Waco

### TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Conscientious
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

### TOOLS AND EQUIPMENT

Mechanic's Tools (e.g., toolbox, wrenches, sockets, hammers, etc.
Measuring Tools
Power Tools
Drill Presses
Power Saws
Power Drills
Hydraulic/Arbor Press
Welding Equipment (SMAW, GMAW, FCAW, Plasma)
Alignment/Calibration Tools
Computer
Forklift
Personal Safety Equipment
Oxyacetylene Equipment
Tool Storage Equipment
Workbenches
Vises
Pedestal Grinders
Pipe Threading Dies
Pipe/Conduit Bending Equipment
A/C Service Equipment
Steam/Boiler System Equipment
Power Transmission Devices
Gasoline Power Plant
Diesel Power Plant
Hydraulic Training Equipment
Electrical Testing Equipment
Air Compressor
Air Powered Tools
Hydraulic Jack
Chain Hoist

### FUTURE TRENDS AND CONCERNS

Statistical Process Control
Composites
Laser Alignment
Advanced Computer Applications
Robotics
Environmental Concerns
Fiber Optic Controls
Automated Material Handling Equipment
More Sophisticated Computer Controls
Hazardous Materials Handling

# COMPETENCY PROFILE
## Industrial Maintenance Mechanic

**Conducted By**
**M.A.S.T.**
**Machine Tool Advanced Skills**
**Technology Program**
**and**
**Consortia Partners**
**(V.199J40008)**

Texas State
Technical College
Waco

REED
TOOL COMPANY
A SUBSIDIARY OF CAMCO

## INDUSTRIAL MAINTENANCE MECHANIC....uses mechanical, pneumatic, hydraulic, and electrical skills to maintain, repair and/or install equipment/machinery used in industry.

| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Operate Machine Tools | A-1 Operate lathes | A-2 Operate milling machines | A-3 Operate drill presses | A-4 Operate boring machines | A-5 Operate pedestal grinders | A-6 Operate surface grinders | A-7 Operate bandsaws | A-8 Operate shapers | A-9 Operate metal shears | A-10 Operate brakes | A-11 Operate cut off saws | A-12 Operate OD and ID grinders | A-13 Machine non-standard parts to support maintenance requirements |
| B | Use Precision Measuring Tools | B-1 Measure with steel rules | B-2 Measure with micrometers | B-3 Measure with transfer type measuring instruments | B-4 Align work with dial indicators | B-5 Measure with dial calipers | B-6 Lay out with height gage | B-7 Use gage blocks | B-8 Use inch and metric systems | | | | | |
| C | Use Hand Tools | C-1 Use files | C-2 Use taps | C-3 Use dies | C-4 Install helicoils | C-5 Use drill motors | C-6 Use impact wrenches | C-7 Use torque wrenches | C-8 Use hacksaws | C-9 Use gasket cutters | C-10 Use wrenches of various types | C-11 Use vises | | |
| D | Discuss Various Production Processes | D-1 Weld using SMAW process in different positions | D-2 Weld different types of joints using the SMAW process | D-3 Cut/weld using the oxyacetylene process in different positions | D-4 Cut/weld different types of joints with oxyacetylene | D-5 Weld with GTAW (heliarc) | D-6 Weld with GMAW (mig) | D-7 Perform welding operations on tool and die precision components | D-8 Perform heat treating operations on tool and die precision components | D-9 Fabricate machinery guards | | | | |
| E | Read/ Interpret Prints | E-1 Interpret mechanical prints | E-2 Interpret electrical prints | E-3 Interpret pneumatic schematics | E-4 Interpret hydraulic schematics | E-5 Interpret welding prints | E-6 Interpret plumbing or piping prints | E-7 Interpret conveyor system prints | E-8 Understand bill of materials callouts | | | | | |
| F | Troubleshoot Equipment and Systems | F-1 Troubleshoot centrifugal pumps | F-2 Troubleshoot positive displacement pumps | F-3 Perform pressure tests on coolant systems | F-4 Maintain compressors | F-5 Troubleshoot blowers | F-6 Understand turbines (gas, steam) | F-7 Install piping | | | | | | |
| G | Repair Industrial Power Plant Systems | G-1 Troubleshoot small gasoline engines | G-2 Troubleshoot medium size gasoline engines | G-3 Troubleshoot medium size natural gas powered engines | G-4 Troubleshoot medium size diesel engines | | | | | | | | | |
| H | Repair Power Transmission Systems | H-1 Troubleshoot gear power transmission drives | H-2 Troubleshoot chain power transmission drives | H-3 Troubleshoot belt drive systems | H-4 Troubleshoot bearings (plane, journal and anti-friction) | H-5 Repair/ replace clutches | H-6 Install and test balanced units | | | | | | | |
| I | Fabricate/ Install Sheetmetal Parts | I-1 Layout sheetmetal parts | I-2 Form and/or bend sheetmetal parts | I-3 Fasten sheetmetal parts together | | | | | | | | | | |
| J | Join Pipes | J-1 Solder metal pipes | J-2 Braze or silver solder metal pipes | J-3 Weld metal pipe joints | J-4 Flair metal tubing | J-5 Swage metal pipe/ tubing | J-6 Join metal pipe with threads | J-7 Join metal pipe with cement | J-8 Join metal pipes with flange joint | J-9 Join plastic pipes with glue | | | | |

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| | Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K | **Start-up New Air Conditioning Systems** | K-1 Check for leaks | K-2 Check for safe operation | K-3 Evacuate and charge system | K-4 Trouble-shoot systems | K-5 Fill hydraulic systems and set flow through coils | K-6 Install thermostats and low voltage wiring | K-7 Install diffusers | K-8 Perform P.M. | | | | | |
| L | **Maintain Boiler and Steam Systems** | L-1 Trouble-shoot systems | L-2 Adjust systems for optimum performance | L-3 Perform P.M. | | | | | | | | | | |
| M | **Troubleshoot Hydraulic Systems** | M-1 Demonstrate working knowledge of hydraulic systems | M-2 Repair/ replace pumps | M-3 Repair/ replace valves | M-4 Repair/ replace cylinders (hydraulic and pneumatic) | M-5 Clean/ replace filters | M-6 Replace seals | M-7 Clean/fill reservoirs | M-8 Replace hoses and couplers | M-9 Repair/ replace motors | M-10 Perform P.M. and service as needed | M-11 Perform repairs on rotary tables with hydraulic mechanisms | | |
| N | **Perform Non-Destructive Testing** | N-1 Test using ultrasonic process | N-2 Test using vibration analysis | N-3 Balance rotating equipment | N-4 Understand and use strain gauges | | | | | | | | | |
| O | **Use Computers** | O-1 Use Lotus 1-2-3 or Quattro Pro | O-2 Use Word Perfect | O-3 Work in a Windows environment | O-4 Use maintenance programs | | | | | | | | | |
| P | **Align Shafts** | P-1 Use feeler gauges | P-2 Use single indicator | P-3 Use double indicator | | | | | | | | | | |
| Q | **Install/ Align Machines** | Q-1 Perform required pipe fitting tasks | Q-2 Grout as necessary | Q-3 Mount using various methods | Q-4 Level and align machine components | Q-5 Discuss finishing materials (i.e., paints, sealers) | Q-6 Perform electrical and pneumatic drilling operations | | | | | | | |
| R | **Demonstrate Knowledge of Building Construction** | R-1 Discuss wood framing techniques | R-2 Discuss metal framing techniques | R-3 Discuss concrete forms and formula testing | R-4 Discuss surveying applications and methods | | | | | | | | | |
| S | **Demonstrate Basic Electrical Skills** | S-1 Read a VOM test meter | S-2 Read and use an amprobe | S-3 Use a voltage tester | S-4 Trouble-shoot PLCs | | | | | | | | | |

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Improvement Activities
Practice Quality-Consciousness in Performance of the Job

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Dean/Technical Education

MIKE FOX
Director/Industry Services

LARRY MYFORD
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TIM INGRAM
Instructor/Auto Body Repair and Refinishing

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JIM WHITE, Vice President/Manufacturing
ROD NIEMANN, Plant Manager/Body Plant
RON STEPHENS, Human Resources Manager
ELAINE SWIGART, Human Resources Supervisor
DONNA TACKETT, Health & Safety Supervisor
BILL GREEN, Body Plant Paint Supervisor
DAVE LAWRENCE, Atsko Sikkens Paint Representative

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Awareness
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Safety Equipment
Personal Safety Equipment (safety glasses, respiratory safety equipment)
Masking Machines
Hydraulic/Electric Body Movers
Parts Holders
Siphon Spray Guns
Gravity-fed Spray Guns
Pressure Pot Equipment
High Volume Low Pressure Equipment
Air Blower
Spray booth
Bake Oven
Air Supplied Breathing Systems
Hand Tools (ratchets, sockets, screwdrivers, etc.)
Storage Equipment
Hand Sanding Equipment

## FUTURE TRENDS AND CONCERNS

Environmental Concerns
High Solids Water-Borne Paint Systems
High Transfer Efficiency Spray Equipment
Composite Body Structure
Hazardous Waste Handling and Costs
Advanced Computer Applications

### COMPETENCY PROFILE

# Paint Application Technician

Prepared by
**Central Florida Community College**

and

**Emergency One, Inc.**

December 1995

**PAINT APPLICATION TECHNICIAN...uses special knowledge and skills to select and apply undercoats and topcoats with consistent quality**

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** Practice Safety | A-1 Demonstrate understanding of safety rules | A-2 Assume personal safety standards for self and others | A-3 Support all safety practices and use protective equipment | A-4 Demonstrate an understanding of proper hazardous material handling | A-5 Know first aid and CPR | A-6 Practice safety in the use of tools | A-7 Follow safety manuals and all regulations and requirements | A-8 Use approved protective equipment | A-9 Follow safe hand and machine tool procedures | A-10 Follow safe spray operation procedures | A-11 Maintain a clean and safe environment | A-12 Control fire hazards | |
| **B** Practice Total Quality | B-1 Apply principles and tools of continuous quality improvement | B-2 Understand the importance of quality in the manufacturing process | B-3 Implement concepts of quality in the workplace | B-4 Follow the Quality Plan and recommend improvements in work methods or testing | B-5 Establish methods, plans and procedures to maintain quality | | | | | | | | |
| **C** Work Ethics | C-1 Be prompt and on the job in accordance with work schedule | C-2 Value honest work ethics and responsibility in the workplace | C-3 Demonstrate high moral values | C-4 Display a neat and clean workplace | C-5 Practice careful use and maintenance of tools and equipment | C-6 Be committed to excellence and quality | C-7 Present a good company image in attire and attitude | C-8 Support a positive work environment | C-9 Practice a positive attitude | | | | |
| **D** Demonstrate Communication Skills | D-1 Be an active listener | D-2 Demonstrate good reading, comprehension, and writing skills | D-3 Summarize and prioritize work responsibilities | D-4 Express ideas clearly | D-5 Demonstrate ability to give and follow directions | D-6 Accept constructive criticism | | | | | | | |
| **E** Work as a Team | E-1 Understand the roles of co-workers | E-2 Respect peer relationships | E-3 Share resources to accomplish necessary tasks | E-4 Facilitate the work ethic by completing tasks on time and accurately | E-5 Be involved in problem solving | E-6 Apply creative thinking | E-7 Support a positive attitude | E-8 Encourage good feelings and morale | E-9 Understand purpose and goals of the organization | E-10 Plan and organize work as a team | E-11 Be willing to lead in areas of knowledge and expertise | E-12 Demonstrate willingness to learn new methods and skills | E-13 Demonstrate good personal relations skills |
| **F** Mathematical Skills | F-1 Exhibit understanding of basic arithmetic functions | F-2 Exhibit understanding of converting fractions and decimals | F-3 Demonstrate practical mathematics in the use of measurement tools | F-4 Interconvert Metric/English measurements | F-5 Perform practical mathematical applications relevant to area of work | F-6 Use applied statistics, graphs, and charts for purposes of analysis and problem-solving | | | | | | | |
| **G** Select and Prepare Materials | G-1 Locate and obtain supplies from proper source | G-2 Check issued materials | G-3 Determine material handling procedures | G-4 Select proper safety equipment | G-5 Select proper application procedure | | | | | | | | |
| **H** Select and Use Proper Tools | H-1 Select proper hand tools for safe and efficient task completion | H-2 Select proper spray equipment | H-3 Select and use proper respiratory safety equipment | H-4 Select and use proper pneumatic pressure settings | H-5 Select and use proper pneumatic pressure equipment for prepaint cleaning | | | | | | | | |
| **I** Select and Operate Shop Equipment | I-1 Select and operate spray booth | I-2 Select and operate hydraulic body movers | I-3 Select and operate wheeled parts holders | I-4 Select and operate compressed air | I-5 Select and operate bake ovens | | | | | | | | |
| **J** Perform Prepaint Operations | J-1 Clean surface to be painted with compressed air | J-2 Inspect all masking and sanding operations completed in prep area | J-3 Correct any preparation flaws | J-4 Clean surface with proper precleaning solvent | J-5 Prepare spray area | J-6 Clean with proper tack cloth | | | | | | | |

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## PAINT APPLICATION TECHNICIAN...continued

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K Perform Paint Operations | K-1 Follow proper safety procedures | K-2 Determine proper paint procedure | K-3 Apply required under-coats | K-4 Determine and follow proper flash time between coats | K-5 Follow required cleaning procedures | K-6 Inspect undercoat application | K-7 Correct any flaws in under-coat | K-8 Select and apply top coat | K-9 Follow proper top coat procedure | K-10 Inspect top coat | K-11 Select and operate bake oven | | |
| L Wellness/ Physical Abilities | L-1 Demon-strate ability to lift 50 pounds | L-2 Demon-strate ability to tolerate heights up to 100 feet | L-3 Ability to work from various positions, while standing on concrete for extended periods | L-4 Display ability to work in hot/cold environment for 8-10 hours | L-5 Present a history of docu-mented regular attendance at work | L-6 Apply wellness information to lifestyle to maintain health | | | | | | | |
| M Emergency Vehicle Terminology | M-1 Display a general under-standing of emergency vehicle terminology | M-2 Understand the functions of equipment being assembled | M-3 Understand how components relate as a total system | | | | | | | | | | |

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
Knowledge of Employee/Employer Responsibilities
Knowledge of Company Quality Improvement Activities
Practice Quality-Consciousness in Performance of the Job

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ELAINE SWIGART, Human Resources Supervisor
DONNA TACKETT, Health & Safety Supervisor
BILL GREEN, Body Plant Paint Supervisor
DAVE LAWRENCE, Atsko Sikkens Paint Representative

E-ONE

## TRAITS AND ATTITUDES

Strong Work Ethic
Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Awareness
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

Safety Equipment
Personal Safety Equipment (safety glasses, respiratory safety equipment)
Grinders
Sanders
Razor Blades
Masking Machines
Parts Holders
Siphon Spray Guns
Gravity-fed Spray Guns
Pressure Pot Equipment
High Volume Low Pressure Equipment
Air Blower
Spray booth
Bake oven
Buffer
Power Drill
Air Ratchets
Hand Tools (ratchets, sockets, screw drivers, etc.)
Storage Equipment
Glass Measurement Equipment
Hand Sending Equipment

## FUTURE TRENDS AND CONCERNS

Environmental Concerns
High Solids Water-Borne Paint Systems
High Transfer Efficiency Spray Equipment
Composite Body Structure
Hazardous Waste Handling and Costs
Advanced Computer Applications

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## COMPETENCY PROFILE

# Paint Detail Technician

Prepared by
Central Florida Community College

and

Emergency One, Inc.

E-ONE®

December 1995

## PAINT DETAIL TECHNICIAN...uses special knowledge and skills to repair minor paint defects and perform final assembly and cleanup operations to a high quality standard

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A Practice Safety | A-1 Demonstrate understanding of safety rules | A-2 Assume personal safety standards for self and others | A-3 Support all practices and use of protective equipment | A-4 Demonstrate an understanding of proper hazardous material handling | A-5 Know first aid and CPR | A-6 Follow safety manuals and all safety requirements | A-6 Use protective equipment | A-7 Follow safe operating procedures for hand and machine tools | A-8 Maintain a clean and safe working environment | A-9 Control fire hazards | | | |
| B Practice Total Quality | B-1 Apply principles and tools of continuous quality improvement | B-2 Understand the importance of quality in the manufacturing process | B-3 Implement concepts of quality in the workplace | B-4 Follow the Quality Plan and recommend improvements in work methods or tooling | B-5 Establish methods, plans, and procedures to maintain quality | | | | | | | | |
| C Work Ethics | C-1 Be prompt and on the job in accordance with work schedule | C-2 Value honest work ethics and responsibility in the workplace | C-3 Demonstrate high moral values | C-4 Display a neat and clean workplace | C-5 Practice careful use and maintenance of tools and equipment | C-6 Be committed to excellence and quality | C-7 Present a good company image in attire and attitude | C-8 Support a positive work environment | C-9 Practice a positive attitude | | | | |
| D Demonstrate Communication Skills | D-1 Be an active listener | D-2 Demonstrate good reading, comprehension, and writing skills | D-3 Summarize and prioritize work responsibilities | D-4 Express ideas clearly | D-5 Demonstrate ability to give and follow instructions | D-6 Accept constructive criticism | | | | | | | |
| E Work as a Team | E-1 Understand the roles of co-workers | E-2 Respect peer relationships | E-3 Share resources to accomplish necessary tasks | E-4 Facilitate the work ethic by completing tasks on time and accurately | E-5 Be involved in problem solving | E-6 Apply creative thinking | E-7 Support a positive attitude | E-8 Encourage good feelings and morale | E-9 Understand purpose and goals of the organization | E-10 Plan and organize work as a team | E-11 Be willing to lead in areas of knowledge and expertise | E-12 Demonstrate willingness to learn new methods and skills | E-13 Demonstrate good personal relations skills |
| F Mathematical Skills | F-1 Exhibit understanding of basic arithmetic functions | F-2 Exhibit understanding of converting fractions and decimals | F-3 Demonstrate practical mathematics in the use of measurement tools | F-4 Interconvert Metric/ English measurements | F-5 Perform practical mathematical applications relevant to area of work | F-6 Use applied statistics, graphs, and charts for purposes of analysis and problem-solving | | | | | | | |
| G Select and Prepare Materials | G-1 Locate and obtain materials | G-2 Check issued materials | G-3 Identify and select supporting materials | G-4 Select and use solvents | G-5 Select and use indirect supplies | G-6 Locate supplies and equipment | | | | | | | |
| H Select and Properly Use Hand Tools | H-1 Select and properly use needed hand tools | H-2 Select and properly use sanding blocks | H-3 Select and properly use compounds | H-4 Select and properly use cleaners | H-5 Select and properly use razor blades | | | | | | | | |
| I Operate Specialized Tools | I-1 Select and operate buffer | I-2 Select and operate spray guns | I-3 Select and operate sanders | I-4 Select and operate power body movers | I-5 Follow procedures specified for each operation | | | | | | | | |
| J Perform Buffing Operations | J-1 Inspect, finish, and identify paint defects | J-2 Determine appropriate repair procedure for paint defects | J-3 Perform color sanding operations | J-4 Perform buffing operations | J-5 Perform final polish operations | J-6 Clean up repair using appropriate cleaner | | | | | | | |

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## PAINT DETAIL TECHNICIAN...continued

**Duties**

**Tasks**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** Perform Spot Repair Operations | K-1 Inspect, finish and identify paint defects | K-2 Determine appropriate repair procedure | K-3 Perform sanding operations | K-4 Perform cleaning operations | K-5 Perform masking operations | K-6 Perform final prepaint cleaning and inspection | K-7 Apply undercoats if needed | K-8 Apply topcoats to coverage as needed | K-9 Perform blending operations | K-10 Inspect final repair, buff if needed | | | |
| **L** Perform Detail Operations | L-1 Remove overspray using recommended procedures | L-2 Touch-up small paint imperfections | L-3 Attach parts using proper hand tools | L-4 Clean glass and chrome using recommended procedures | L-5 Perform final inspection | | | | | | | | |
| **M** Emergency Vehicle Terminology | M-1 Display a general understanding of emergency vehicle terminology | M-2 Understand the functions of equipment being assembled | M-3 Understand how components relate as a total system | | | | | | | | | | |
| **N** Wellness/ Physical Abilities | N-1 Demonstrate ability to lift 50 pounds | N-2 Demonstrate ability to tolerate heights up to 100 feet | N-3 Ability to work from vasrious positions while standing on concrete for extended periods | N-4 Display ability to work in hot/cold environment for 8-10 hours | N-5 Present a history of documented regular attendance at work | N-6 Apply wellness information to lifestyle to maintain health | | | | | | | |

## SKILLS AND KNOWLEDGE

Communication Skills
Use Measurement Tools
Use Inspection Devices
Mathematical Skills
Reading/Writing Skills
Knowledge of Safety Regulations
Practice Safety in the Workplace
Organizational Skills
Mechanical Aptitude
Ability to Comprehend Written/Verbal Instructions
Basic Knowledge of Fasteners
Ability to Work as Part of a Team
Converse in the Technical Language of the Trade
Knowledge of Occupational Opportunities
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E-ONE

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Interpersonal Skills
Punctuality
Dependability
Honesty
Neatness
Safety Awareness
Motivation
Responsible
Physical Ability
Professional
Trustworthy
Customer Relations
Personal Ethics

## TOOLS AND EQUIPMENT

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Personal Safety Equipment (safety glasses, respiratory safety equipment)
Grinders
Sanders
Razor Blades
Masking Machines
Parts Holders
Hydraulic Body Movers
Air Blower
Spray Equipment
Storage Equipment

## FUTURE TRENDS AND CONCERNS

Environmental Concerns
High Solids Water-Borne Paint Systems
High Transfer Efficiency Spray Equipment
Composite Body Structure
Hazardous Waste Handling and Costs
Advanced Computer Applications

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## COMPETENCY PROFILE

# Paint Preparation Technician

Prepared by
**Central Florida Community College**

and

**Emergency One, Inc.**

E-ONE®

December 1995

**PAINT PREPARATION TECHNICIAN...uses special knowledge and skills to complete all required procedures prior to application of topcoats**

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** Practice Safety | A-1 Demonstrate understanding of safety rules | A-2 Assume personal safety standards for self and others | A-3 Support all practices and use of protective equipment | A-4 Demonstrate an understanding of proper hazardous material handling | A-5 Know first aid and CPR | A-6 Follow safety manuals and all regulations and requirements | A-7 Use protective equipment | A-8 Follow safe hand and machine tool procedures | A-9 Maintain a clean and safe environment | A-10 Control fire hazards | | | |
| **B** Practice Total Quality | B-1 Apply principles and tools of continuous quality improvement | B-2 Understand the importance of quality in themanufacturing process | B-3 Implement concepts of quality in the workplace | B-4 Follow the Quality Plan and recommend improvements in work methods or tooling | B-5 Establish methods, plans and procedures to maintain quality | | | | | | | | |
| **C** Work Ethics | C-1 Be prompt and on the job in accordance with work schedule | C-2 Value honest work ethics, dedication, and responsibility in the workplace | C-3 Demonstrate high moral values | C-4 Display a neat and clean workplace | C-5 Practice careful use and maintenance of tools and equipment | C-6 Be committed to excellence and quality | C-7 Present a good company image in attire and attitude | C-8 Support a positive work environment | C-9 Practice a positive attitude | | | | |
| **D** Demonstrate Communication Skills | D-1 Be an active listener | D-2 Demonstrate good reading, comprehension and writing skills | D-3 Be able to document manufacturing procedures for each specific job | D-4 Be able to prepare recommendations for continuous improvement | D-5 Summarize and prioritize work responsibilities | D-6 Be able to give and follow directions and accept constructive criticism | D-7 Be able to verbally communicate with co-workers and management | | | | | | |
| **E** Work as a Team | E-1 Understand the roles of co-workers | E-2 Respect peer relationships | E-3 Share resources to accomplish necessary tasks | E-4 Facilitate the work ethic by completing tasks on time and accurately | E-5 Be involved with problem solving | E-6 Apply creative thinking | E-7 Support a positive attitude | E-8 Encourage good feelings and morale | E-9 Understand purpose and goals of the organization | E-10 Plan and organize work as a team | E-11 Be willing to lead in areas of knowledge and expertise | E-12 Demonstrate willingness to learn new methods and skills | E-13 Demonstrate good personal relations skills |
| **F** Mathematical Skills | F-1 Exhibit understanding of basic arithmetic functions | F-2 Exhibit understanding of converting fractions and decimals | F-3 Demonstrate practical mathematics in the use of measurement tools | F-4 Interconvert Metric/ English measurements | F-5 Perform practical mathematical applications relevant to area of work | F-6 Use applied statistics, graphs, and charts for purposes of analysis and problem-solving | | | | | | | |
| **G** Select and Prepare Materials | G-1 Locate and obtain supplies from proper source | G-2 Check issued materials | G-3 Determine material handling procedures | G-4 Select proper sandpaper grit for application | G-5 Select proper chemical for job application | | | | | | | | |
| **H** Select and Use Proper Tools | H-1 Exhibit proper use of hand tools for safe and efficient task completion | H-2 Properly use sanders | H-3 Properly use safety apparel | H-4 Properly use masking equipment | H-5 Properly use sockets, wrenches, and screwdrivers | H-6 Properly use spreaders and scrapers | H-7 Properly use sanding blocks | H-8 Properly use spray equipment | | | | | |
| **I** Select and Use Proper Shop Equipment | I-1 Select and use wheeled parts holders | I-2 Select and use hydraulic body movers | I-3 Select and use compressed air | I-4 Select and use exhaust fans | | | | | | | | | |
| **J** Perform Aluminum Preparation for Painting | J-1 Select and use proper chemical cleaning process | J-2 Complete proper sanding operation | J-3 Complete post sanding cleaning operation | J-4 Select and use proper masking materials | J-5 Select and use proper masking techniques | J-6 Final inspection of masking and sanding operations | J-7 Transfer bodies or parts to next work station | | | | | | |

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## PAINT PREPARATION TECHNICIAN...continued

**Duties** ← **Tasks** →

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** Perform Under Coat Preparation for Painting | K-1 Select and use proper chemical cleaning process | K-2 Complete proper sanding operation | K-3 Complete post sanding cleaning operation | K-4 Select and use proper masking materials | K-5 Select and use proper masking techniques | K-6 Final inspection of masking | | | | | | | |
| **L** Wellness/ Physical Abilities | L-1 Demonstrate ability to lift 50 pounds | L-2 Demonstrate ability to tolerate heights up to 100 feet | L-3 Ability to work from various positions while standing on concrete for extended periods | L-4 Display ability to work in hot/cold environment for 8-10 hours | L-5 Present a history of documented regular attendance at work | L-6 Apply wellness information to lifestyle to maintain health | | | | | | | |
| **M** Emergency Vehicle Terminology | M-1 Display a general understanding of emergency vehicle terminology | M-2 Understand the functions of equipment being assembled | M-3 Understand how components relate as a total system | | | | | | | | | | |

### SKILLS AND KNOWLEDGE

- Communication Skills
- Use Measurement Tools
- Use Inspection Devices
- Mathematical Skills
- Reading/Writing Skills
- Knowledge of Safety Regulations
- Practice Safety in the Workplace
- Organizational Skills
- Mechanical Aptitude
- Ability to Comprehend Written/Verbal Instructions
- Basic Knowledge of Fasteners
- Ability to Work as Part of a Team
- Converse in the Technical Language of the Trade
- Knowledge of Occupational Opportunities
- Knowledge of Employee/Employer Responsibilities
- Knowledge of Company Quality Improvement Activities
- Practice Quality-Consciousness in Performance of the Job

### CENTRAL FLORIDA COMMUNITY COLLEGE PROGRAM REPRESENTATIVES

DR. HUGH ROGERS
Dean/Technical Education

MIKE FOX
Director/Industry Services

LARRY MYFORD
Coordinator/Manufacturing Technology

KEN DEWHURST
Instructor/Indistrial Machinery Maintenance & Repair

### EMERGENCY ONE, INC. MANAGEMENT TEAM AND EXPERT WORKERS

DAN WOMBOLD, Vice President Human Resources
JIM WHITE, Vice President/Manufacturing
BILL RHODES, Production Manager/Body Plant
RON STEPHENS, Human Resources Manager
ELAINE SWIGART, Human Resources Supervisor
DONNA TACKETT, Health & Safety Supervisor
A. SMITH, Plant Manager/Aerial Plant
R. RENWICK, Supervisor
A. CRAIG, Engineer

E-ONE

### TRAITS AND ATTITUDES

- Strong Work Ethic
- Interpersonal Skills
- Punctuality
- Dependability
- Honesty
- Neatness
- Safety Awareness
- Motivation
- Responsible
- Physical Ability
- Professional
- Trustworthy
- Customer Relations
- Personal Ethics

### TOOLS AND EQUIPMENT

- Screwdrivers, Wrenches, etc.
- Electric Drills and Saws
- Measuring Tools
- Caulking Guns
- Basic Drafting Tools
- Electrical Lighting Equipment
- General Tools (Hacksaws, Sheet Metal Snips, Diagonal Cutting Pliers, Etc.)
- Cut-off Saws
- Hand Grinders
- Hand Tapping Holes
- Hand Reamers
- Files
- Pipe Threading Machines
- Pneumatic Hose Assembly Tools
- Hydraulic Fitting Assembly Tools

### FUTURE TRENDS AND CONCERNS

- Reamers
- Socket Drives
- Pop Rivets

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## COMPETENCY PROFILE

# Plumbing/Hydraulic Mechanic

**Prepared by**
**Central Florida Community College**

**and**

**Emergency One, Inc.**

E-ONE®

**December 1995**

E-ONE

## PLUMBING/HYDRAULICS MECHANIC...uses mechanical, pneumatic, and hydraulic skills to maintain, repair and/or install equipment/ machinery used in industry

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** Follow Safety Practices | A-1 Demonstrate understanding of safety rules | A-2 Assume personal safety standards for self and others | A-3 Support all practices and use of protective equipment | A-4 Demonstrate an understanding of proper hazardous material handling | A-5 Know first aid and CPR | A-6 Practice safety in the use of tools | A-7 Wear personal safety equipment | A-8 Maintain safe work station | A-9 Protect from ARC flash | A-10 Demonstrate eye safety precautions | A-11 Perform grinding and brushing technique safety | A-12 Maintain adequate ventilation | A-13 Mark "hot-work" |
| **B** Practice Total Quality | B-1 Apply principles and tools of continuous quality improvement | B-2 Understand the importance of quality in the manufacturing process | B-3 Implement concepts of quality in the workplace | B-4 Follow the Quality Plan and recommend improvements in work methods or tooling | B-5 Establish methods, plans and procedures to maintain quality | | | | | | | | |
| **C** Work Ethics | C-1 Be prompt and on the job in accordance with work schedule | C-2 Value honest work ethics, dedication, and responsibility in the workplace | C-3 Demonstrate high moral values | C-4 Display a neat and clean workplace | C-5 Practice careful use and maintenance of tools and equipment | C-6 Be committed to excellence and quality | C-7 Present a good company image in attire and attitude | C-8 Support a positive work environment | C-9 Practice a positive attitude | | | | |
| **D** Demonstrate Communication Skills | D-1 Be an active listener | D-2 Demonstrate good reading, comprehension and writing skills | D-3 Be able to document manufacturing procedures | D-4 Be able to prepare recommendations for continuous improvement | D-5 Summarize and prioritize work responsibilities | D-6 Be able to give and follow directions and accept constructive criticism | D-7 Be able to verbally communicate with co-workers and management | | | | | | |
| **E** Work as a Team | E-1 Understand the roles of co-workers | E-2 Respect peer relationships | E-3 Share resources to accomplish necessary tasks | E-4 Facilitate the work ethic by completing tasks on time and accurately | E-5 Be involved with problem solving | E-6 Apply creative thinking | E-7 Support a positive attitude | E-8 Encourage good feelings and morale | E-9 Understand purpose and goals of the organization | E-10 Plan and organize work as a team | E-11 Be willing to lead in areas of knowledge and expertise | E-12 Demonstrate willingness to learn new methods and skills | E-13 Demonstrate good personal relations skills |
| **F** Mathematical Skills | F-1 Exhibit understanding of basic arithmetic fractions | F-2 Exhibit understanding of converting fractions and decimals | F-3 Demonstrate practical mathematics in the use of measurement tools | F-4 Interconvert Metric/ English measurements | F-5 Perform practical mathematical applications relevant to area of work | F-6 Use applied statistics, graphs, and charts for purposes of analysis and problem-solving | | | | | | | |
| **G** Engineering Drawings and Control Documents | G-1 Exhibit ability to interpret blueprint notes and dimensions | G-2 Exhibit understanding of basic layout of drawings | G-3 Exhibit understanding of basic types of drawings | G-4 Demonstrate ability to list the purpose of each type of drawing | G-5 Demonstrate ability to verify drawing elements | G-6 Practice geometric dimensioning and tolerancing methodology | G-7 Exhibit ability to read and interpret prints from different occupations | | | | | | |
| **H** Precision Measuring Tools | H-1 Exhibit ability to identify types of measurement | H-2 Exhibit ability to select proper measurement tools | H-3 Demonstrate application of proper measuring techniques | H-4 Demonstrate use of Metric and English Standards of Measurement | H-5 Perform measurements with hand held instruments | H-6 Verify measuring instruments are calibrated and in calibration schedule | | | | | | | |
| **I** Hand Tools | I-1 Exhibit use of screwdrivers, wrenches, hacksaws, pliers, files, metal snips, etc. | I-2 Demonstrate use of electric drills, saws, grinders, impact wrenches, torque wrenches, etc. | I-3 Exhibit use of hand taps, reamers, installing helicoils | I-4 Demonstrate use of pipe threading appliances; internal and external | I-5 Demonstrate use of pneumatic and hydraulic hose fittings and assembly, sealing techniques | I-6 Demonstrate use of shop presses to remove/install bearings, etc. | I-7 Exhibit use and cleanup of caulking guns, and proper disposal of waste materials | | | | | | |
| **J** Equipment and Systems | J-1 Display knowledge of troubleshooting for various equipment and systems | | | | | | | | | | | | |

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## PLUMBING/HYDRAULIC MECHANIC...continued

| Duties | Tasks | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **K** Hydraulic/Pneumatic Devices | K-1 Demonstrate use of test equipment | K-2 Describe basic principles of hydraulic systems | K-3 Identify hydraulic fluids | | | | | | | | | | |
| **L** Align Shafts | L-1 Demonstrate use of feeler gauges | L-2 Demonstrate use of single indicator | L-3 Demonstrate use of double indicator | L-4 Demonstrate use of double reverse indicator | | | | | | | | | |
| **M** Emergency Vehicle Terminology | M-1 Display a general understanding of emergency vehicle terminology | M-2 Understand the functions of equipment being assembled | M-3 Understand how components relate as a total system | | | | | | | | | | |
| **N** Wellness/Physical Abilities | N-1 Demonstrate ability to lift 50 pounds | N-2 Demonstrate ability to tolerate heights up to 100 feet | N-3 Ability to work from various positions while standing on concrete for extended periods | N-4 Display ability to work in hot/cold environment for 8-10 hours | N-5 Present a history of documented regular attendance at work | N-6 Apply wellness information to lifestyle to maintain health | | | | | | | |

# APPENDIX B - PILOT PROGRAM NARRATIVE

What follows is a narrative of the pilot program which was conducted for this particular occupational specialty.

September 16, 1996

Mr. Wallace Pelton
Site Coordinator
Texas State Technical College
3801 Campus Drive
Waco, TX 76705

Dear Wallace:

Every effort was and is being made to fulfill the expectations of the Machine Tool Advanced Skills Technology (MAST) Program with respect to the pilot program. After reviwing the parameters needed to meet the requirements for the MAST prgram, the following areas were addressed: 1) need of conducting a year pilot program during the school year 1995-1996; 2) need of using two pilot programs at this partnering location; and 3) need for 25 students. The original expectation from Augusta Technical Institute was to conduct industrial assessment, curriculum development, pilot program, student assessment and project deliverables in CADD and CNC technical specialty area. However, after consulting with related curriculum areas at Tech here, local industry, and other MAST partners, it was decided to change our emphasis at Augusta Technical Institute to the Instrumentation and Industrial Maintenance Mechanic technical specialty areas.

We have spent many hours conducting the initial phases of the project for the CNC and CADD technical specialty areas. This change caused us to start the five-step process for Instrumentation and Industrial Maintenance Mechanic this year. This resulted in insufficient time to conduct a high quality pilot program with 25 students for one year (between 1995 and 1996) in Instrumentation and Industrial Maintenance Mechanic specialty areas.

Plans have been implemented to conduct the pilot program during the 1996-1997 school year. Recruiting has begun. The pilot program will be conducted in both Instrumentation and Industrial Maintenance Mechanic curriculum areas. The $6,000 scholarship from MAST will be distributed with $3,000 distributed among 15 Instrumentation students and $3,000 distributed among 15 Industrial Maintenance Mechanic students. Students are applying for the MAST pilot programs now. Industrial assessment and industrial validation have taken place for both Instrumentation and Industrial Maintenance Mechanic areas. Curriculum development is actively under way. Student assessment is written and planned with great care. Project deliverables are being prepared. There is a lot of enthusiasm about the two pilot programs. Augusta Technical Institute is excited about these ventures.

Industrial Maintenance Mechanic is a one-year diploma program; and the pilot program will cover the entire year. The Instrumentation program is a two-year associate degree program. Our emphcais for the pilot program for the Instrumentation curriculum will be on the second year students with a GPA of 2.5 or higher.

Enclosed are an information sheet and application for both the instrumentation and Industrial Maintenance Mechanic pilot programs. Please feel free to call me if you require further information.

Sincerely,

Ronnie Lambert
MAST Site Coordinator - Augusta Technical Institute

# MAST Program
# INDUSTRIAL MAINTENANCE MECHANIC

The Machine Tool Advanced Skills Technology (MAST) Program, a U.S. Department of Education sponsored grant funded through the Office of Vocational and Adult Education (award #V199J40008) includes funds for student scholarships. The money will be available for tuition, fees, and books for students. Students applying for scholarships will need to meet our normal entrance requirements as outlined in the ATI catalog. As part of the terms of the scholarship, achievements of each student will be followed as they progress through the curriculum and into the workplace.

We can fund 15 students in Industrial Maintenance Mechanic and 15 students in Instrumentation Technology. The monetary amount available for each curriculum is $3,000 to be distributed among 15 students.

## MAST Program Application
## INDUSTRIAL MAINTENANCE MECHANIC

Please complete all requested information.

---

1. Name______________________________ ______________________ _____________
(Last) (First) (MI)

2. Address__________________________________________________

3. City_______________________________________________

4. State_____________________ 5. Zip Code______________

6. Sex: Male__________ Female__________

*For more information:*

**MAST Program Director**
**Texas State Technical College**
**3801 Campus Drive**
**Waco, TX 76705**

**(817) 867-4849**
**FAX (817) 867-3380**
**1-800-792-8784**
**http://machinetool.tstc.edu**